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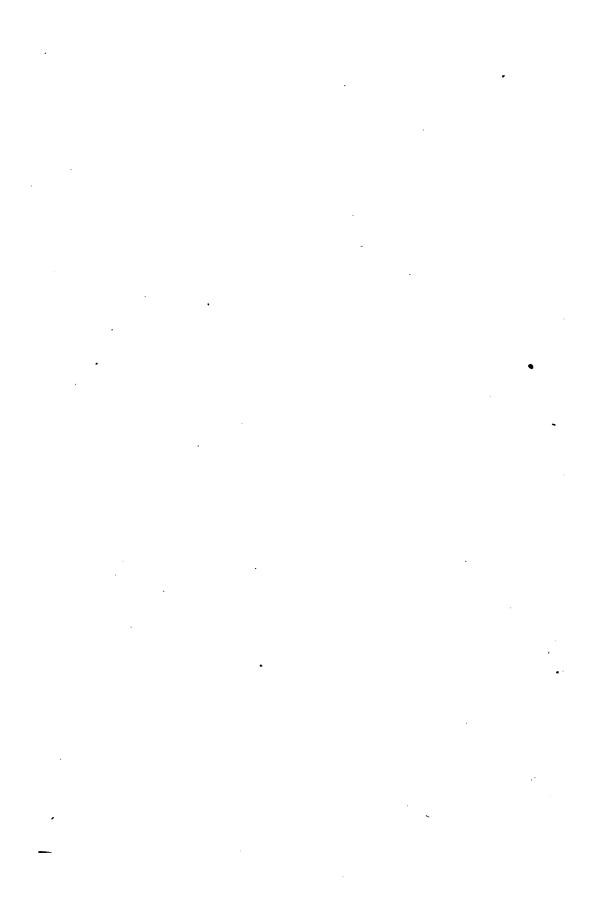
FROM THE

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J ∴ H. O. No. 84

MEXICAN AND CENTRAL AMERICAN PILOT

(PACIFIC COAST)

FRCM

THE UNITED STATES TO COLOMBIA INCLUDING THE GULFS OF CALIFORNIA AND PANAMA

PUBLISHED BY THE HYDROGRAPHIC OFFICE UNDER THE AUTHORITY OF THE SECRETARY OF THE NAVY

FIFTH EDITION



WASHINGTON
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1918

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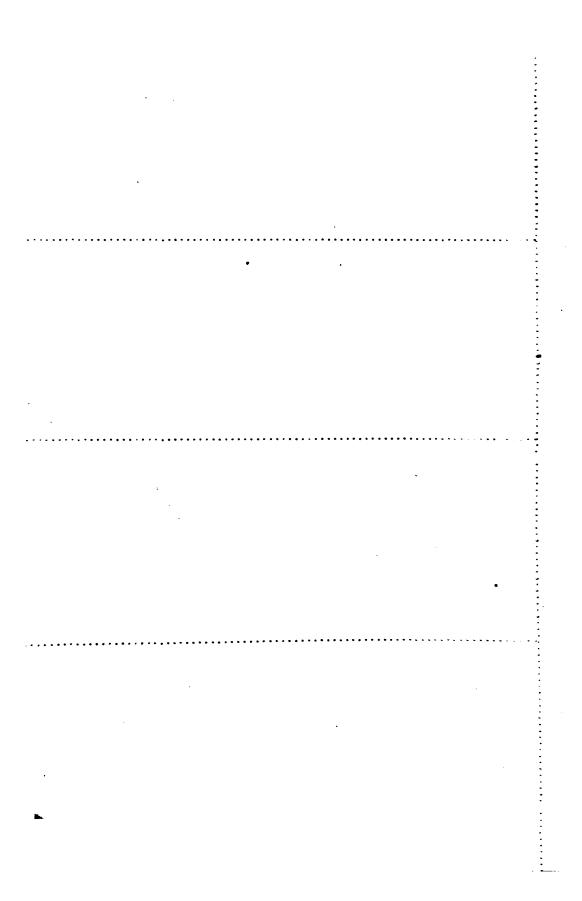
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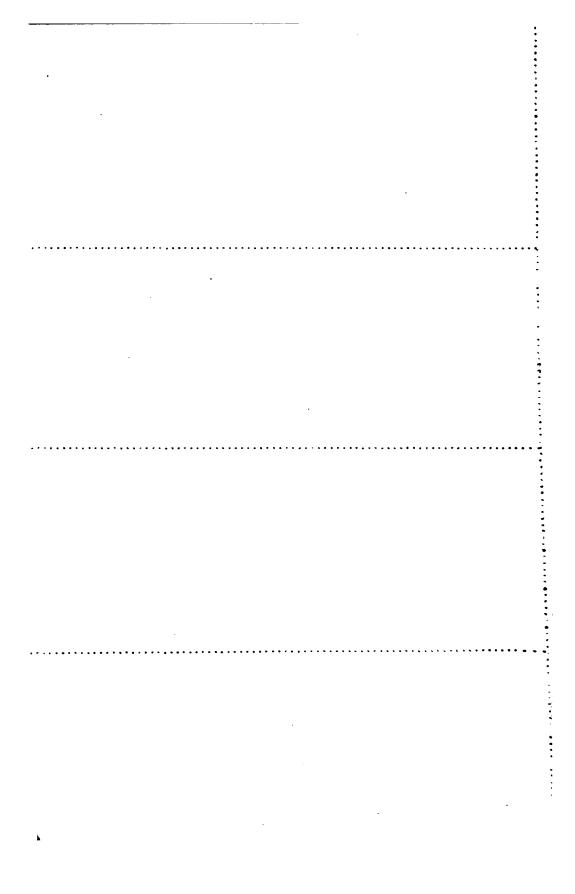
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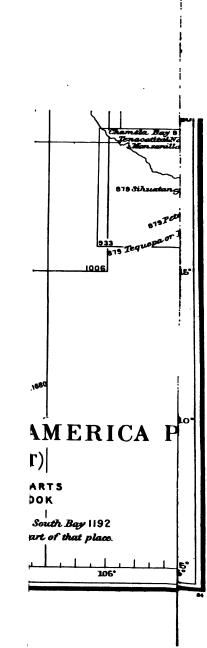
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PREFACE.

This publication comprises the sailing directions for the west coast of Mexico and Central America, including the Gulfs of California and Panama.

This work was originally derived from the surveys of the United States steamers Narragansett, Tuscarora, Ranger, and Thetis between the years 1873 and 1901. Later editions have been amplified from time to time by information from various sources. The present edition has been brought up to date by hydrographic information, port facilities, etc., received from consular officials, officers of the Navy and the merchant marine, and includes corrections from Notices to Mariners up to No. 11 of 1918.

The bearings and courses are true and are given in degrees, from 0° (north) to 360° (clockwise).

Bearings limiting sectors of lights are toward the light.

The directions of winds refer to the points from which they blow; of currents, the points toward which they set. These directions are true.

Variations, with the annual rate of change, may be obtained from H. O. chart No. 2406, "Variation of the Compass."

Distances are expressed in nautical miles, the mile being approximately 2,000 yards.

Unless otherwise stated soundings are referred to mean low water and heights are referred to mean high water.

The latest information regarding lights, their characteristics, sectors, fog signals, and submarine bells should always be sought in the Light Lists.

Summary of Notices to Mariners.—While it is the intention of the Hydrographic Office to publish about the first of each year a Summary of Notices to Mariners, of the preceding year, affecting the volume, it must be understood that these summaries are intended to include only important changes and corrections and that their publications may be discontinued at any time, especially when a new edition of the book is issued.

Mariners are requested to notify the U. S. Hydrographic Office, Washington, D. C., or one of its branch offices, of errors they may discover in this publication, or of additional matter which they think should be inserted.



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INFORMATION RELATING TO NAVIGATIONAL AIDS AND GENERAL NAVIGATION.

THE CORRECTION OF CHARTS, LIGHT LISTS, AND SAILING DIRECTIONS.

The following publications are issued by the United States Hydrographic Office as guides to navigation: Charts, Chart Catalogues, Sailing Directions, Light Lists, Tide Tables, Notices to Mariners, Pilot Charts, and Hydrographic Bulletins. Of these, the Notices to Mariners and the Hydrographic Bulletins are free to mariners and others interested in shipping. The Pilot Charts are free to contributors of professional information, but are sold to the general public at 10 cents a copy. The other publications of the office are sold under the law at cost price.

The Charts, the Sailing Directions, and the Light Lists are all affected by continual changes and alterations, concerning which information from all parts of the world is published weekly in the Notices to Mariners.

The charts are always corrected for all available information up to the date of issue stamped upon them; and the Light Lists should be noted for the recent alterations and additions. The Sailing Directions, however, can not, from their nature, be so fully corrected, and in all cases where they differ from the charts, the charts must be taken as the guide.

Charts.—When issued from the Hydrographic Office, the charts have received all necessary corrections to date.

All small but important corrections that can be made by hand are given in the Notices to Mariners, and should at once be placed on the charts to which they refer.

Extensive corrections that can not be conveniently thus made are put upon the plates, and new copies are put on sale. Masters of vessels are urged to replace the old charts, which should be destroyed to prevent the possibility of their being used in the navigation of the ship.

The dates on which extensive corrections are made are noted on the chart on the right of the middle of the lower edge; those of the smaller corrections at the left lower corners.

The edition, and corresponding date, of the chart will be found in the right lower corner, outside the outer neat line. In all cases of quotations of charts, these dates of corrections should be given, as well as the number of the chart (found in the lower right and upper left corners), in order that the edition of the chart referred to may be known.

The Light Lists are corrected before issue, and all changes are published in the weekly Notices to Mariners.

The navigating officer should make notations in the tabular form in the Light Lists and paste in at the appropriate places slips from the Notices to Mariners.

The Light Lists should always be consulted as to the details of a light, as the description in the sailing directions is not complete, and may be obsolete, in consequence of changes since publication.

The Sailing Directions or Pilots are kept corrected by addenda; and subsequent to date of last addenda, they should be kept corrected by means of the Notices to Mariners. Sailing Directions issued to naval vessels carry with them an envelope containing slips of corrections up to date of issue.

Addenda are published from time to time, and contain a summary of all the information received up to date since the publication of the volume to which they refer, canceling all previous Notices to Mariners.

To enable the books to be more conveniently corrected, addenda and Notices to Mariners are printed on one side only, and two copies of the latter are issued to each naval vessel, one to be cut and the slips pasted in at the appropriate places, the other to be retained intact for reference.

To paste in the slips, as the Notices to Mariners are received, is one of the duties of the navigating officer, demanding faithful attention.

It must, however, be understood that Sailing Directions will rarely be correct in all details, and that, as already stated, when differences exist, the chart, which should be corrected from the most recent information, should be taken as the guide, for which purpose, for ordinary navigation, it is sufficient.

The Tide Tables, which are published annually by the United States Coast and Geodetic Survey, give the predicted times and heights of the high and the low waters for every day in the year at 70 of the principal ports of the world. and, through the medium of these by means of tidal differences and ratios, at a very large number of subordinate ports. The tables for the Atlantic and the Pacific coast ports of the United States are also published separately.

It should be remembered that these tables aim to give the times of high and low water, and not the times of turning of the current or of slack water, which may be quite different.

Notices to Mariners, containing newly acquired information pertaining to various parts of the world, are published weekly and

mailed to all United States ships in commission, Branch Hydrographic offices and agencies, and United States consulates. Copies are furnished free by the main office or by any of the branch offices on application.

With each Notice to naval vessels is sent also a separate sheet, giving the items relating to lights contained in the latest Notice, intended especially for use in correcting the Light Lists.

Pilot Charts of the North Atlantic, Central American Waters, and North Pacific and Indian Oceans are published each month, and of the South Atlantic and South Pacific Oceans each quarter. These charts give the average conditions of wind and weather, barometer, percentage of fog and gales, routes for steam and sailing vessels for the period of issue, ice, and derelicts for the preceding period, ocean currents and magnetic variation for the current year, storm tracks for preceding years, and much other useful information. They are furnished free only in exchange for marine data or observations.

Hydrographic Bulletins, published weekly, are supplemental to the Pilot Charts, and contain the latest reports of obstructions and dangers along the coast and principal ocean routes, ice, derelicts, and wreckage, reports of the use of oil to calm the sea, and other information for mariners. They are to be had free upon application.

THE USE OF CHARTS.

Accuracy of chart.—The value of a chart must manifestly depend upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become.

To judge of a survey, its source and date, which are generally given in the title, are a good guide. Besides the changes that may have taken place since the date of the survey, in waters where sand or mud prevails, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail; until a chart founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbors and their approaches, no surveys yet made have been so thorough as to make it certain that all dangers have been found. The number of the soundings is another method of estimating the completeness of the survey, remembering, however, that the chart is not expected to show all the soundings that were obtained. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

Large or irregular blank spaces among soundings mean that no soundings were obtained in these spots. When the surrounding soundings are deep it may fairly be assumed that in the blanks the water is also deep; but when they are shallow, or it can be

seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion. This is especially the case in coral regions and off rocky coasts, and it should be remembered that in waters where rocks abound it is always possible that a survey, however complete and detailed, may have failed to find every small patch or pinnacle rock.

A wide berth should therefore be given to every rocky shore or patch, and instead of considering a coast to be clear, the contrary should be assumed.

Fathom curves a caution.—Except in charts of harbors that have been surveyed in detail, the 5-fathom curve on most charts may be considered as a danger line or caution against unnecessarily approaching the shore or bank within that line, on account of the possible existence of undiscovered inequalities of the bottom, which only an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time required for so detailed a survey. It is not contemplated that ships will approach the shores in such localities without taking special precautions.

The 10-fathom curve on rocky shores is another warning, especially for ships of heavy draft.

A useful danger curve will be obtained by tracing out with a colored pencil, or ink, the line of depth next greater than the draft of the ship using the chart. For vessels drawing less than 18 feet the edge of the sanding serves as a well-marked danger line.

Charts on which no fathom curves are marked must especially be regarded with caution, as indicating that soundings were too scanty and the bottom too uneven to enable the curves to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always be avoided, especially if ringed around, as it is doubtful how closely the spot may have been examined and whether the least depth has been found.

The chart on largest scale should always be used on account of its greater detail and the greater accuracy with which positions may be plotted on it.

Caution in using small-scale charts.—In approaching the land or dangerous banks, regard must always be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on one of small scale the same amount of displacement means a large fraction of a mile.

Distortion of printed charts.—The paper on which charts are printed from engraved plates has to be damped. On drying distortion takes place from the inequalities of the paper, which greatly

varies with different papers and the amount of the damping; but it does not affect navigation. The larger the chart the greater the amount of this distortion. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted on the chart, especially if the lines to objects be long.

Mercator chart.—Observed bearings are not identical with those measured on the Mercator chart (excepting only the bearings north and south, and east and west on the Equator) because the line of sight, except as affected by refraction, is a straight line and lies in the plane of the great circle, while the straight line on the chart (except the meridian line) represents, not the arc of a great circle, but the loxodromic curve, or rhumb line, which on the globe is a spiral approaching but never in theory reaching the pole, or, if the direction be east and west, a circle of latitude.

The difference is not appreciable with near objects, and in ordinary navigation may be neglected. But in high latitudes, when the objects are very distant and especially when lying near east or west, the bearings must be corrected for the convergence of the meridians in order to be accurately placed on the Mercator chart, which represents the meridians as parallel.

On the polyconic chart, since a straight line represents (within the limits of 15 or 20 degrees of longitude) the arc of a great circle or the shortest distance between two points, bearings of the chart are identical with observed bearings.

The Mercator projection is unsuited to surveying, for which purpose the polyconic projection is used by the Hydrographic Office and the Coast and Geodetic Survey.

Notes on charts should always be read with care, as they may give important information that can not be graphically represented.

Buoys.—Too much reliance should not be placed on buoys always maintaining their exact positions. They should therefore be regarded as warnings, and not as infallible navigational marks, especially when in exposed places and in the winter time, and a ship's position should always, when possible, be checked by bearings or angles of fixed objects on shore.

Gas buoys.—The lights shown by gas buoys can not be implicitly relied on; the light may be altogether extinguished, or, if periodic, the apparatus may get out of order.

Whistle and bell buoys are sounded only by the action of the sea; therefore, in calm weather, they are less effective or may not sound.

Lights.—All the distances given in the Light Lists and on the charts for the visibility of lights are calculated for a height of 15 feet for the observer's eye. The effect of a greater or less height

of eye can be ascertained by means of the table of distances of visibility due to height, published in the Light Lists.

The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Refraction, too, may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light, the fact may be forgotten that aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be obtained from the standard compass when you lay down from aloft.

On first making a light from the bridge, by at once lowering the eye several feet and noting whether the light is made to dip, it may be determined whether the ship is on the circle of visibility corresponding with the usual height of the eye, or unexpectedly nearer the light.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower or order, as stated in the Light Lists, and in some cases by noting how much its visibility in clear weather falls short of the range corresponding to its height. Thus, a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather, is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

Fog signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the influence of the wind large areas of silence have been found in different directions and at different distances from the origin of sound, even in clear weather; therefore, too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal often requires some time before it is in readiness to act. A fog often creeps imperceptibly toward the land, and may not be observed by the lighthouse keepers until upon them; a ship may have been for many hours in it, and approaching the land in confidence, depending on the signal, which is not sounded. When sound travels against the wind, it may be thrown upward; a man aloft might then hear it though inaudible on deck.

The submarine bell system of fog signals is much more reliable than systems transmitting sound through the air, as sound traveling in water is not subject to the same disturbing influences; the fallibility of the lighthouse keeper is, however, about the same in all systems, so that caution should be observed even by vessels equipped with submarine-bell receiving apparatus.

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Submarine bells have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus may determine the approximate bearing of the signal. These signals may be heard also on vessels not equipped with receiving apparatus by observers below the water line, but the bearing of the signal can not then be readily determined.

Vessels equipped with radio apparatus and submarine bell receivers may fix their distance from a light vessel having radio and submarine bell, utilizing the difference in velocity of sound waves of the radio and the bell. Sound travels 4,794 feet per second at 66° F. in water, and the travel of radio sound waves for practicable distances may be taken as instantaneous.

All vessels should observe the utmost caution in closing the land in fogs. The lead is the safest guide and should be faithfully used.

Tides.—A knowledge of the times of high and low water and of the amount of vertical rise and fall of the tide is of great importance in the case of vessels entering or leaving port, especially when the low water is less than or near their draft. Such knowledge is also useful at times to vessels running close along a coast, in enabling them to anticipate the effect of the tidal currents in setting them on or offshore. This is especially important in fog or thick weather.

The predicted times and heights of the high and low waters, or differences by which they may be readily obtained, are given in the Tide Tables for all the important ports of the world. The height at any intermediate time may be obtained by means of Table 2 for most of the principal tidal stations of the United States, given in Table 1, and for the subordinate stations of Table 1 by using them as directed in the Tide Tables. The intermediate height may also be obtained by plotting the predicted times and heights of high and low water and connecting the points by a curve. Such knowledge is often useful in crossing a bar or shallow flats.

Planes of reference.¹—The plane of reference for soundings on Hydrographic Office charts made from United States Government surveys and on Coast and Geodetic Survey charts of the Atlantic coast of the United States is mean low water; on the Pacific coast of the United States as far as the Strait of Juan Fuca, it is the mean of the lower low waters; and from Puget Sound to Alaska, the plane employed on Hydrographic Office charts is low water ordinary springs.

On most of the British Admiralty charts the plane of reference is the low water of ordinary springs; on French charts, the low water of equinoctial springs.

¹The distinction between "rise" and "range" of the tide should be understood. The former expression refers to the height attained above the datum plane or soundings, differing with the difference planes of reference; the latter, to the difference of level between successive high and low waters.

In the case of many charts compiled from old or various sources the plane of reference may be in doubt. In such cases, or whenever not stated on the chart, the assumption that the reference plane is low water ordinary springs gives a larger margin of safety than mean low water.

Whichever plane of reference may be used for a chart it must be remembered that there are times when the tide falls below it. Low water is lower than mean low water about half the time, and when a new or full moon occurs at perigee the low water is lower than the average low water of springs. At the equinoxes the spring range is also increased on the coasts of Europe, but in some other parts of the world, and especially in the Tropics, such periodic low tides may coincide more frequently with the solstices.

Wind or a high barometer may at times cause the water to fall below even a very low plane of reference.

On coasts where there is much diurnal inequality in the tides, the amount of rise and fall can not be depended upon and additional caution is necessary.

Mean sea level.—The important fact should be remembered that the depths at half tide are practically the same for all tides, whether neaps or springs. Half tide therefore corresponds with mean sea level. This makes a very exact plane of reference, easily found, to which it would be well to refer all high and low waters.

The Tide Tables give in Table 1, for all the ports, the plane of reference to which tidal heights are referred and its distance below mean sea level. See also explanation of Table 2.

If called on to take special soundings for the chart at a place where there is no tidal bench mark, mean sea level should be found and the plane for reductions established at the proper distance below it, as ascertained by the Tide Tables, or by observations, or in some cases, if the time be short, by estimation, the data used being made a part of the record.

Tidal streams.—In navigating coasts where the tidal range is considerable, especial caution is necessary. It should be remembered that there are indrafts to all bays and bights, although the general run of the stream may be parallel with the shore.

The turn of the tidal stream offshore is seldom coincident with the times of high and low water on the shore. In some channels the tidal stream may overrun the turn of the vertical movement of the tide by three hours, forming what is usually known as tide and half tide, the effect of which is that at high and low water by the shore the stream is running at its greatest velocity.

The effect of the tidal wave in causing currents may be illustrated by two simple cases.

(1) Where there is a small tidal basin connected with the sea by a large opening.

(2) Where there is a large tidal basin connected with the sea by a

small opening.

In the first case the velocity of the current in the opening will have its maximum value when the height of the tide within is changing most rapidly, i. e., at a time about midway between high and low water. The water in the basin keeps at approximately the same level as the water outside. The flood stream corresponds with the rising and the ebb with the falling of the tide.

In the second case the velocity of the current in the opening will have its maximum value when it is high water or low water without, for then there is the greatest head of water for producing motion. The flood stream begins about three hours after low water, and the ebb stream about three hours after high water, slack water thus occurring about midway between the tides.

Along most shores not much affected by bays, tidal rivers, etc., the current usually turns soon after high water and low water.

The swiftest current in straight portions of tidal rivers is usually in the middle of the stream, but in curved portions the most rapid current is toward the outer edge of the curve, and here the water will be deepest. The pilot rule for best water is to follow the ebb tide reaches.

Countercurrents and eddies may occur near the shores of straits, especially in bights and near points. A knowledge of them is useful in order that they may be taken advantage of or avoided.

A swift current often occurs in a narrow passage connecting two large bodies of water, owing to their considerable difference of level at the same instant. The several passages between Vineyard Sound and Buzzards Bay are cases in point. In the Woods Hole passage the maximum strength of the tidal streams is at about high and low water.

Tide rips are made by a rapid current setting over an irregular bottom, as at the edges of banks where the change of depth is considerable.

Current arrows on charts show only the most usual or the mean direction of a tidal stream or current; it must not be assumed that the direction of a stream will not vary from that indicated by the arrow. The rate, also, of a stream constantly varies with circumstances, and the rate given on the chart is merely the mean of those found during the survey, possibly from very few observations.

FIXING POSITION.

Sextant method.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with a protractor, sextant angles between three well-defined objects on

shore which are shown on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

For its successful employment it is necessary: First, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice. Two observers are better for this method.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand distant objects should be used for direction, because less affected by a small error or change of position.

The three-arm protractor or station pointer consists of a graduated brass circle with one fixed and two movable radial arms, the three beveled edges of the arms, if produced, intersecting at the exact center of the instrument. The edge of the fixed arm marks the zero of the graduation which enables the movable arms to be set at any angles with the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The transparent xylonite protractor is an excellent substitute for the brass instrument and in some cases preferable to it, as when, for instance, the objects angled on are so near the observer that they are more or less hidden by the circle of the instrument. The xylonite protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through three objects (in which case the sum of the observed angles equals the supplement of the angle at the middle object made by lines from the other two) it will be indeterminate, as it will plot all around the circle. Such an observation is called a "revolver." An approach to this condition must be avoided. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for

navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range of two objects give in general an excellent fix, easily obtained and plotted.

Advantages of sextant method.—In many narrow waters where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

In all cases where great accuracy of position is desired, such as the fixing of a rock or shoal, or of fresh soundings or new buildings as additions to the chart, the sextant should invariably be used. In all such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained not only prevent any errors, but they at once furnish a means of checking the accuracy of the chart itself. If a round of angles can be taken the observer's accuracy is also checked. In the case of ordinary soundings a third angle need be taken only occasionally; first, to check the general accuracy of the chart, as above stated; second, to make certain that the more important soundings, as at the end of a line, are correctly placed.

If communication can be had with the shore, positions may be fixed with great accuracy by occupying with theodolite or sextant two known points of the chart. The third angle of the triangle, that between the two points at the position sought, should be measured as a check.

The compass.—It is not intended that the use of the compass to fix the ship should be given up; in ordinary piloting the compass, with its companion, the pelorus, may be usefully employed for this purpose, although less accurate than the sextant.

If the accuracy of the chart is doubtful, the compass should be used in preference to the sextant.

In fixing by the compass, it should always be remembered that a position by two bearings only, like that by two angles only, is liable to error. An error may be made in taking a bearing, or in applying to it the deviation, or in taying it on the chart. A third or check bearing should, therefore, be taken of some other object, especially when near the shore or dangers. A common intersection for the three lines assures accuracy.

When the three lines do not intersect in a point, the following rule holds: If the line drawn to the middle object falls to the right of the point of intersection of the lines to the two outside objects, the position of the observer was to the right of the line to the middle object; and if it falls to the left of the intersection his position was to the left of the line. Thus it will be seen that the assumption, that the position is at the center of the triangle formed by the intersecting lines, is incorrect.

Doubling the angle on the bow.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

When the first bearing is 26½° from ahead, and the second 45°, the run between bearings will equal the distance at which the object will be passed abeam.

A table of multipliers of the distance run in the interval between any two bearings of an object, the product being its distance at the time of the second bearing, is given in the Light Lists and in Bowditch.

Danger angle.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, caution is necessary, as should the chart be inaccurate, i. e., should the objects selected be not quite correctly placed, the angle taken off from it may not serve the purpose. It should not, therefore, be employed when the survey is old or manifestly imperfect.

The vertical danger angle may be conveniently used when passing elevated points of known heights, such as lighthouses, cliffs, etc. The computation of the distance corresponding to the height of the object and its angular elevation requires for small distances merely the solution of a plain right triangle; the natural cotangent of the angle multiplied by the height in feet gives the distance in

feet. The convenient use of this method, however, requires tables such as those published by Capt. Lecky in his little book entitled "The Danger Angle and Offshore Distance Tables." This book very usefully extends the vertical angle method to finding a ship's position at sea by observing the angular altitude of a peak of known height and its bearing. The tables give heights up to 18,000 feet and distances up to 110 miles.

When the angles are not too large they should be observed "on and off the limb" and the index error of the sextant thus eliminated, in preference to correcting for it the single altitude. It must be remembered that in high latitudes the bearing of a distant object needs correction for the convergence of the meridians before being laid down on a Mercator chart. The correction may be found by the following formula, using the approximate position: The sine of the correction equals the product of the sine of half the difference of longitude by the sine of the middle latitude. It is applied on the equatorial side of the observed bearing and its effect is always to increase the latitude of the observer.

Soundings taken at random are of little value in fixing or checking position and may at times be misleading. In thick weather, when near or closing the land, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By laying the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart, keeping the line representing the track parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined. This plan was suggested by Lord Kelvin, whose admirable sounding machine renders the operation of sounding possible in quite deep water, without slowing down the ship and consequent loss of time.

Pelorus.—All ships should be supplied with the means of taking accurate bearings both by night and by day. The standard compass is not always conveniently placed for the purpose; in such case a pelorus will be very useful, but the results are not as accurate as those obtained direct from the compass. The utility of such an instrument in ascertaining the change of bearing of an approaching ship should not be overlooked.

Position lines.—Among the various methods of fixing position at sea, the one which should be best understood and put to the most constant use is that employing position or Sumner lines. These lines give the most comprehensive information to the navigator with the least expenditure of labor and time. The knowledge gained is that the vessel must be somewhere on the line, provided the data used is accurate and the chronometer correct. As the information

given by one line of position is not sufficient to determine the definite location of the vessel, it is necessary to cross this line by another similarly obtained, and the vessel being somewhere on both must be at their intersection. However, a single line, at times, will furnish the mariner with invaluable information; for instance, if it is directed toward the coast, it marks the bearing of a definite point on the shore, or if parallel to the coast, it clearly indicates the distance off, and so will often be found useful as a course. A sounding taken at the same time with the observation will in certain conditions prove of great value in giving an approximate position on the line.

The easiest and quickest way to establish a line of position is by employing the method of Marcq St. Hilaire, as modified by the use of tables of altitude. The principle of this method is one of altitude differences, in which the observed altitude is compared with the computed altitude for a dead reckoning, or other selected position, and the difference in minutes of latitude measured toward the body along the line of its azimuth, if the observed altitude is greater than the computed altitude, and vice versa. A line drawn at right angles to the line of azimuth through the point thus determined is the position line, somewhere upon which will be found the position of the vessel. The tables of altitude obviate the computation of the altitude and thereby greatly facilitate the establishment of the line.

A position line may also be found by computing two positions for longitude with two assumed latitudes, and drawing the line between them; or by drawing to the position obtained with one latitude a line at right angles to the bearing of the body as taken from the azimuth tables.

A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The position lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

The morning and evening twilight observations, besides their great accuracy, possess the additional advantage of greatly extending the ship's reliable reckoning beyond the limits of the ordinary day navigation, and correspondingly restricting the dead reckoning uncertainties of the night. An early morning fix in particular is often of great value. Though the same degree of

accuracy as at twilight can not be expected, night observations are very valuable and should be assiduously practiced.

Piloting.—The navigator, in making his plan for entering a strange port, should give very careful previous study to the chart and sailing directions, and should select what appear to be the most suitable marks for use, also providing himself with substitutes to use in case those selected as most suitable should prove unreliable in not being recognized with absolute certainty. Channel buoys seen from a distance are difficult to identify, because their color is sometimes not easily distinguished and they may appear equally distant from the observer even though they be at widely varying Ranges should be noted, if possible, and the lines drawn, both for leading through the best water in channels, and also for guarding against particular dangers; for the latter purpose safety bearings should in all cases be laid down where no suitable ranges appear to offer. The courses to be steered in entering should also be laid down and distances marked thereon. If intending to use the sextant and danger angle in passing dangers, and especially in passing between dangers, the danger circles should be plotted and regular courses planned, rather than to run haphazard by the indications of the angle alone, with the possible trouble from bad steering at critical points.

The ship's position should not be allowed to be in doubt at any time, even in entering ports considered safe and easy of access, and should be constantly checked, continuing to use for this purpose those marks concerning which there can be no doubt until others are unmistakably identified.

The ship should ordinarily steer exact courses and follow an exact line, as planned from the chart, changing course at precise points, and, where the distances are considerable, her position on the line should be checked at frequent intervals. This is desirable even where it may seem unnecessary for safety, because if running by the eye alone and the ship's exact position be immediately required, as in a sudden fog or squall, fixing at that particular moment may be attended with difficulty.

The habit of running exact courses with precise changes of course will be found most useful when it is desired to enter port or pass through inclosed waters during fog by means of the buoys; here safety demands that the buoys be made successively, to do which requires, if the fog be dense, very accurate courses and careful attention to the times, the speed of the ship, and the set of the current; failure to make a buoy as expected leaves, as a rule, no safe alternative but to anchor at once, with perhaps a consequent serious loss of time.

In passing between dangers where there are no suitable leading marks, as, for instance, between two islands or an island and the main shore, with dangers extending from both, a mid-channel course may be steered by the eye alone with great accuracy, as the eye is able to estimate very closely the direction midway between visible objects.

In piloting among coral reefs or banks, a time should be chosen when the sun will be astern, conning the vessel from aloft or from an elevated position forward. The line of demarcation between the deep water and the edges of the shoals, which generally show as green patches, is indicated with surprising clearness. This method is of frequent application in the numerous passages of the Florida Keys.

Changes of course should in general be made by exact amounts, naming the new course or the amount of the change desired, rather than by ordering the helm to be put over and then steadying when on the desired heading, with the possibility of the attention being diverted and so of forgetting in the meantime, as may happen, that the ship is still swinging. The helmsman, knowing just what is desired and the amount of the change to be made, is thus enabled to act more intelligently and to avoid bad steering, which in narrow channels is a very positive source of danger.

Coast piloting involves the same principles and requires that the ship's position be continuously determined or checked as the landmarks are passed. On well-surveyed coasts there is a great advantage in keeping near the land, thus holding on to the marks and the soundings, and thereby knowing at all times the positions rather than keeping offshore and losing the marks, with the necessity of again making the land from vague positions, and perhaps the added inconvenience of fog or bad weather, involving a serious loss of time and fuel.

The route should be planned for normal conditions of weather, with suitable variations where necessary in case of fog or bad weather or making points at night, the courses and distances, in case of regular runs over the same route, being entered in a notebook for ready reference, as well as laid down on the chart. The danger circles for either the horizontal or the vertical danger angles should be plotted, wherever the method can be usefully employed, and the angles marked thereon; many a mile may thus be saved in rounding dangerous points with no sacrifice in safety. Ranges should also be marked in, where useful for position or for safety, and also to use in checking the deviation of the compass by comparing in crossing, the compass bearing of the range with its magnetic bearing, as given by the chart.

Changes of course will in general be made with mark or object abeam, the position (a new "departure") being then, as a rule, best and most easily obtained. The pelorus should be at all times in readiness for use, and the chart where it may be readily consulted by the officer of the watch. The sextant should also be kept conveniently at hand.

A continuous record of the progress of the ship should be kept by the officer of the watch, the time and patent-log reading of all changes of course and of all bearings, especially the two and four point bearings, with distance of object when abeam, being noted in a book kept in the pilot house for this especial purpose. The ship's reckoning is thus continuously cared for as a matter of routine and without the presence or particular order of the captain or navigating officer. The value of thus keeping the reckoning always fresh and exact will be especially appreciated in cases of sudden fog or when making points at night.

Where the coastwise trip must be made against a strong head wind, it is desirable, with trustworthy charts, to skirt the shore as closely as possible in order to avoid the heavier seas and adverse current that prevail farther out. In some cases, with small ships, a passage can be made only in this way. The important saving of coal and of time, which is even more precious, thus effected by skillful coast piloting makes this subject one of prime importance to the navigator.

Change in the variation of the compass. —The gradual change in the variation must not be forgotten in laying down on the chart courses and bearings. The magnetic compasses placed on the charts for the purpose of facilitating the plotting become in time slightly in error, and in some cases, such as with small scales or when the lines are long, the displacement of position from neglect of this change may be of importance. The date of the variation and the annual change, as given on the compass rose, facilitate corrections when the change has been considerable. The compasses are reengraved once in ten years; more frequent alterations on one spot in a copperplate would not be practicable.

The change in the variation is in some parts of the world so rapid as to need careful consideration, requiring a frequent change of the course. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles.

Local magnetic disturbance of the compass on board ship.—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the

¹See H. O. Chart No. 2406, Variation of the compass

ship. Observation shows that disturbance of the compass in a ship affoat is experienced in only a few places on the globe.

Magnetic laws do not permit of the supposition that the visible land causes such disturbance, because the effect of a magnetic force diminishes so rapidly with distance that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong, the compass may be temporarily deflected when passing over such a spot; but the area of disturbance will be small unless there are many centers near together.

Use of oil for modifying the effect of breaking waves.— Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

The following may serve for the guidance of scamen, whose attention is called to the fact that a very small quantity of oil, skillfully applied, may prevent much damage both to ships, especially of the smaller classes, and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

- 1. On free waves, i. e., waves in deep water, the effect is greatest.
- 2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.
- 3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when no other oil is obtainable, or it may be mixed with other oils; all animal and vegetable oils, such as waste oil from the engines, have great effect.
- 4. In cold water, the oil, being thickened by the low temperature and not being able to spread freely, will have its effect much reduced, a rapid-spreading oil should be used.
- 5. A small quantity of oil suffices, if applied in such a manner as to spread to windward.
- 6. It is useful in a ship or boat either when running, or lying-to, or in wearing.
- 7. When lowering and hoisting boats in a heavy sea the use of oil has been found greatly to facilitate the operation.
- 8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to permit leakage. The waste pipes forward are also very useful for this purpose.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan.

On a bar, with the ebb tide running, it would seem to be useless

to try oil for the purpose of entering.

- 10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside, bearing in mind that her natural tendency is always to forge ahead. If she is aground the effect of oil will depend upon attending circumstances.
- 11. For a boat riding in bad weather to a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat, and the bag readily hauled on board for refilling, if necessary.

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CHAPTER I.

GENERAL REMARKS.

Plan.—This book comprises the western coasts of Mexico and Central America, southward as far as Panaman-Colombian boundary.

Geography.—Central America is divided into six independent republics: Guatemala, Honduras, Panama, Costa Rica, Nicaragua, and Salvador, besides the territory of Belize, or British Honduras, situated upon the eastern side of the peninsula of Yucatan.

Mexico, a Federal Republic, includes within its boundaries Lower California, and comprises 27 States, 2 Territories, and the Federal district of Mexico, or 30 political divisions in all; its total area is 767.005 square miles. It has an extensive seaboard to both the Atlantic and Pacific Oceans, between the latitudes 15° N. and 32° N., and comprises one of the richest and most varied zones in the world. For the most part, the surface consists of an immense table-land, which commences in the United States, as far north as Colorado, and gradually rises from 3,700 feet at El Paso, on the northern frontier, to over 8,100 feet at Marquez (the highest point touched by the Central Railway), 76 miles northward of Mexico City; and a mean elevation, nearly as great, is maintained in all the south-central plateau. The escarpments of this plateau form most of the so-called Cordilleras. The most important range is the Sierra Madre (over 10,000 feet and extending from Tehuantepec into the United States); parallel with this run the sierras of the east coast and of Lower California. The surface of the country is also much broken up by short cross ridges and detached peaks, the principal being the Cordillera de Anahuac, culminating in Nevado de Toluca (19,454 feet) and Popocatepetl (17,523 feet).

In a region where lofty ranges and plateau formations, with steep escarpments, approach almost everywhere to within a few miles of the coast, little space is left for the development of large river basins. Most of the streams are little more than mountain torrents, rushing impetuously from terrace to terrace seaward. Many also flow through the profound rocky gorges or barrancas, which form a characteristic feature of the Mexican table-lands. Hence the rivers are almost useless for irrigation purposes, and available as means of communication only for short distances in their lower reaches, where

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they flow through the narrow alluvial strips of coast lands to the sea. The Rio Grande de Santiago, the largest on the Pacific side, is almost everywhere obstructed by falls and rapids; the next in importance, the Mercala or Rio de las Balsas, is subject to sudden freshets during the rains.

In the plateau region, or tierras templadas, the climate is almost that of perpetual spring, and the atmosphere remarkably free from moisture. Wood in this upland region is scarce and dear, though there are valuable forests in the extreme north and south. coast lands, wood and water are abundant and the soil fertile, but the climate is such that white men can not work as laborers there. coast belt and the terraces, up to 3,000 feet, constitute the tierras calientes, where the temperature ranges from 60° to 110° F. lands, or tierras frias, embrace all the country above about 8,000 feet, including the few highest peaks covered with perpetual snow. South of about latitude 28° N. there are only two seasons, the wet and the dry, the former from May to October, the latter prevailing for the rest of the year. The rains generally begin on the east coast, gradually working westward. Farther north there are four seasons: but in the highest zone the rainfall is very scanty, and northern Mexico and the Californian Peninsula are exposed to seasons of drought.

Mexico is rich in minerals, many of which have been worked from an early date. Lead is found in many parts, at some points in the form of galenas in connection with argentiferous ores, in others entirely independent of the silver. Lead mines, properly so called, are found in considerable quantities, specially at the Lomo de Toro, in the district of Zimapan, at Queretaro, at Cadereyta, Matamoras in Pueblo, and Oajaca. Copper is largely mined in some sections, being found in a pure state in Chiapas and Guanajuato, and elsewhere associated with gold. Lower California is very rich in copper; in Santa Agueda there are more than 30 mines in operation; other beds exist in the municipalities of La Paz, San Antonio, Todos Santos, Santiago, Mulege, and Comandu. Tin is one of the metals as yet but little mined, although there are plentiful deposits in many portions of the Republic; of all the Mexican tin mines none can be compared with the immense deposits of the Coneto region, situated about 36 miles south of the Partido of Inde, in Durango.

The principal ports on the Pacific coast are those of Guaymas, Mazatlan, Manzanillo, Acapulco, and Salina Cruz, but there are several minor ports which will be described in the body of this work in due course. The exports consist of silver and gold, copper, flax, and hemp, cabinet woods and dyewoods, hides, coffee, sugar, tobacco, and vanilla. The chief imports are cotton, linen, and woolen goods, hardware, machinery, and provisions. Nearly two-thirds of the trade is with the United States.

The Mexican Railway system has now acquired a considerable development, and in 1906 about 13,500 miles of railway were open, and in 1901 43,920 miles of telegraph and nearly 22,000 miles of telephones; most of the latter are of a private character, and at present there is a very small extension of line for the use of the general public. The City of Mexico is now connected with the United States Railway system at three different points on the northern frontier, viz, El Paso, by the Central Railway, Eagle Pass, by the International, and Laredo, by the National. By the latter route it is possible to reach New York in five days. The Interoceanic line across the Tehuantepec Isthmus connects the ports of Salina Cruz on the Pacific with Puerto Mexico on the Gulf of Mexico. The only port on the Pacific at present connected with a main railway system is Guaymas, the terminus of the Sonora Railway, connecting with the United States Southern Pacific Railway, at Nogales, on the frontier, and Benson, in the United States.

The population of Mexico by census in 1910 was 15,160,369. The foreign population amounted to 116,527. In 1910 the population of Mexico, the capital city, was 471,066 by census.

Part and weather signals.—The following weather signals will be made at all meteorological observations, pilot offices, and port lighthouses in Mexico and at the general office for lighthouses at Vera Cruz, on a flagstaff, painted in red and white bands, with a yard painted white, the staff above the yard being also painted white:

The weather for the port is signaled from one yardarm; the weather that may be expected outside from the other.

1. WEATHER EXPECTED AT THE PORT WHERE THE SIGNAL IS MADE. The following flags indicate the force of the wind:

A square yellow flag, with a square white center, indicates that light to moderate winds may be expected.

A square white flag, with a square red center, indicates that strong winds may be expected.

A square red flag, with a square black center, indicates that a gale may be expected.

The following flags, hoisted with one of the flags indicating the force of the wind, indicate the probable direction of the wind:

A square blue flag over that indicating the force of the wind denotes wind from the northward, between north-northeast and north-northwest.

A square blue flag under that indicating the force of the wind denotes wind from the southward, between south-southeast and south-southwest.

A red pennant over the flag indicating the force of the wind denotes wind from the northeastward, between north-northeast and east-northeast.

A red pennant under the flag indicating the force of the wind denotes wind from the southeastward, between south-southeast and east-southeast.

A white pennant over the flag indicating the force of the wind denotes wind from the northwestward, between north-northwest and west-northwest.

A white pennant under the flag indicating the force of the wind denotes wind from the southwestward, between south-southwest and west-southwest.

A blue pennant over the flag indicating the force of the wind denotes wind from the eastward, between east-northeast and east-southeast.

A blue pennant under the flag indicating the force of the wind denotes wind from the westward, between west-northwest and west-southwest.

Example.—A square blue flag, over a square yellow flag, with a square white center, indicates that light to moderate winds between north-northeast and north-northwest may be expected.

Storm signal: Two square red flags with square black centers, hoisted vertically, indicate a hurricane liable to visit the port or to pass close by.

Note.—When this signal is made further information should be obtained from the observatory.

2. WEATHER EXPECTED OUTSIDE THE PORTS:

A square red flag, with a square white center, indicates the existence of a hurricane in the Antilles, the course of which can not yet be ascertained.

A square yellow flag, with a square red center, indicates bad weather in the Gulf of Mexico.

A triangular white flag, with a triangular black center, indicates bad weather to the northward.

A triangular black flag, with a trangular white center, indicates bad weather to the southward.

Note.—When the signals indicating bad weather to the northward or southward are made, further information should be obtained from the observatory.

3. NIGHT SIGNALS:

Two red lights, placed vertically, indicate that strong winds may be expected from the northward, between northeast and northwest.

Two white lights, placed vertically, indicate that strong winds may be expected from the southward, between southeast and southwest.

A white light over a red light indicates that strong winds may be expected from the eastward, between northeast and southeast.

A red light over a white light indicates that strong winds may be expected from the westward, between northwest and southwest.

Storm signal: Three red fixed lights, placed vertically, indicate a hurricane liable to visit the port, or to pass close by.

Note.—When the storm signal is made, further information should be obtained from the observatory.

4. Port signals:

Shown on a flagstaff, painted in red and white bands, over the pilot office.

A red ball indicates that the departure of native vessels is prohibited.

A black cone indicates that the departure of small vessels is prohibited.

A black cylinder indicates that the movement of small vessels is prohibited.

Guatemala, the northernmost of the Central American Republics, extends from latitude 13° 42′ N. to 17° 49′ N., and is bounded on the north and west by Mexico, and on the east by British Honduras and the Republics of Honduras and Salvador; it includes an area of 46,774 square miles. It is traversed from west to east by an elevated mountain chain, containing several volcanic summits, five of which rise to over 10,000 feet above the sea, and earthquakes are of frequent occurrence. The country is well watered by numerous rivers and mountain streams, but the configuration of the country is such that in many parts water in the dry season is scarce, sometimes for drinking purposes unobtainable.

Though the flat lands near the coast are hot and unhealthful, the climate in the interior, considering that it is within the Tropics, is healthful, on account of the extremely mountainous character of the country. The temperature is fairly equable all the year round, varying in range according to altitude; in the low lands the thermometer rarely falls below 70° at night, or rises above 90° in the daytime; on the plateaus, though the midday sun has great power, the range from 60° to 80° is rarely exceeded, and on the tops of some of the volcanoes dew freezes and forms ice in the dry winters.

The seasons are practically divided into wet and dry; rain commences to fall in April, gradually increasing in persistency and volume till October, from the end of which month scarcely any rain whatever falls until the next wet season commences. The rainy season is tempered by almost daily sunshine for a few hours, the mornings being generally fine, a condition highly favorable for the growth of all vegetation, but toward the end of the dry season everything is burnt up and the ground becomes hard. The average

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rainfall during the year is a fraction over 53 inches. April and May are the hottest months and December and January the coldest.

The population in 1913 was estimated at 2,119,165; about 60 per cent are pure Indians, the remainder being composed of Ladinos or half caste, with comparatively a small number of pure descendants from Spanish settlers. The foreign population in 1893 numbered 11,331. Guatemala la Nueva, the capital of the Republic, has a population of 96,560, five-sixths of them of European origin.

There are no harbors whatever on the Pacific side; the three ports of San Jose, Champerico, and Ocos are simply landing places on an open coast, iron piers being thrown out, and vessels lying at anchor in the swell some 500 yards farther out. On the Atlantic side are the ports of Livingston, and a new port, called Port Barrios or Santo Tomas, in Honduras Gulf, intended to be terminus of the railroad between Guatemala and the Atlantic, which is now under construction.

There are about 502 miles of railway open: From San Jose through Escuintla to the capital, 72 miles, and from Champerico to Retalhuleu, 27 miles, and one from Retalhuleu to San Felipe. The northern railroad connects Port Barrios with the capital. A branch line connecting the San Jose line with Istapa is in operation, also the western railroad, the Ocos Railroad, and the Vera Paz Railroad belonging to private companies; in 1902 a branch line connecting Mazatenango with the central main line was opened.

In 1913 there were 4,319 miles of telephone and telegraph lines. The telephone extends over 491 miles; it appears to be rapidly spreading throughout the country.

The principal export is coffee; the other articles of export are hides, indigo, sugar, india rubber, mahogany, sarsaparilla, and fruits. The imports are cotton and woolen goods, flour, wine, and railway material.

Exchange has undergone enormous fluctuations in recent years. The currency consists of paper.

Salvador, the smallest, though in point of population the second, of the Central American Republics, extends along the Pacific coast for 170 miles, with a general breadth of 43 miles. The area of this Republic is only 7,288 square miles. It is bounded on the north and east by the Republic of Honduras, and on the west by that of Guatemala. The population in 1914 was by census 1,225,835 persons; aborigines and mixed races constitute the bulk of the population, among whom live about 20,000 whites or descendants of Europeans. The chief town, San Salvador, has a population of about 66,000. The first city of that name was overwhelmed by an earthquake in 1854, and most of the inhabitants erected dwellings on a neighboring site, at present called Nueva San Salvador. The new capital suffered

in a similar manner in 1873 and 1879, but has been rebuilt. Earth-quakes are frequent, but the country has, of late years, enjoyed comparative immunity from them. The principal exports are coffee, indigo, tobacco, sugar, silver, balsam, and hides; the imports are cotton goods, provisions, and hardware. The only harbor is La Union, in the Gulf of Fonseca, Acajutla and Libertad being mere open roadsteads only of importance from their proximity to the cities of San Salvador and Sonsonate. A railway connects the port of Acajutla with Santa Ana, the coffee center, and Ateos with San Tecla; with this system San Salvador was brought into connection in 1900. Other railways are being constructed. There is a railroad from La Union to the important town of San Miguel. There are 203 telegraph offices, with 2,372 miles of wire, and 176 telephone offices with 2,081 miles of wire.

Honduras, the middle State of Central America, has an area of 46,250 square miles, and a coast line of nearly 400 miles on the Atlantic, but of only 40 miles on the Gulf of Fonseca on the Pacific side; the chief port on the south side is Amapala. The country is mountainous, being traversed by the Cordilleras. The population of the State in 1914 was estimated to be 562,000, mostly of aboriginal blood. The chief town, Tegucigalpa, has about 28,950 inhabitants. and is situated near the center of the State. The products consist chiefly of mahogany, cattle, hides, and india rubber; the imports are cotton goods and hardware. A wagon road is being made from Tegucigalpa to the Pacific coast, and it is probable that a really good communication will shortly be established in that part of the country. Motor vehicles are running on the part of the road which is available. A railway runs from Puerto Cortez, in the Gulf of Honduras, to San Pedro Sula, and thence to La Pimienta, a distance of 58 miles; this is to be developed into an interoceanic railway connecting the Atlantic with the Pacific. These 58 miles of railway are now in the hands of the Government; it has been completely overhauled and repaired. There is about 100 miles of branch line under construction.

In 1912 there were 3,812 miles of telegraph, with 245 offices. The telephone is in use in the capital and some other towns.

Nicaragua, with a total area of about 49,200 square miles, is the largest State of Central America; it has a long seaboard on both the Atlantic and Pacific coasts, and includes a large portion of the Mosquito territory. The population in 1910 was 600,000. The great mass of the population consists of aboriginal Indians, mulattoes, negroes, and mixed races, the number of Europeans and their descendants being only about 1,200, but on the increase. The old capital of the Republic is the city of Leon, now partly in ruins; it lies 10 miles from the Pacific coast and is surrounded by five active volcanoes.

The seat of government at present is the town of Managua, on the southern border of the lake of the same name. The population of Managua is about 34,872.

The chief exports are coffee, gold, and india rubber; the latter is becoming scarcer every year. The ports on the Pacific side are San Juan del Sur and Corinto. A railway through the cities of Chinandega, Leon, and Managua connects Corinto with Granada on Lake Nicaragua. The line from Massaya to Jinotepe, connecting the coffee district with Corinto, has been continued to Diriamba. There were in 1908, 3,637 miles of telegraph, with 130 offices, and 805 miles of telephone.

Costa Rica extends across the isthmus from latitude 8° 17' N. to 11° 10' N., and is bounded on the southeast by the Republic of Panama, and on the north by the Republic of Nicaragua, the boundary between Costa Rica and Nicaragua being from Punta Castilla on the Atlantic side to the center of a line joining Punta Arranca Barba and Punta Sacate on the Pacific side. The language of the country is Spanish, not pure Castilian, but English is spoken more in Costa Rica than in any other of these Republics. The area of the Republic is about 2,300 square miles. The population is the smallest of the six Republics, though closely approaching that of Panama; at the end of 1913 it was estimated to be 410,981, a small proportion being foreigners. San Jose, the capital, had then a population of about 33,900; it is in telegraphic communication with London, and can be reached by travelers from that city in 21 days, and from New York in 18 days. The principal ports are Limon on the Atlantic, and Punta Arenas on the Pacific.

The climate is mild and healthful, especially in the higher altitudes where there is neither excess of heat nor cold, nor malignant diseases; only on the coast now and again a few cases of fever are met with. The seasons are two, the dry and the wet; the former from November to May, and the latter from May to the end of October; the first three months of the rainy season being agreeable and refreshing after the period of dry weather.

The soil is exceedingly productive, and, owing to the different elevations, products of both the Temperate and Torrid Zones are grown. The cool lands are from 5,000 to 6,000 feet above the sea, and from them several volcanoes rise to heights of from 8,000 to 11,000 feet. The forests, which extend over a large portion of the Republic, abound in timber suitable for shipbuilding, and in mahogany, brazil, and various other valuable dyewoods. The cultivated portion lies principally within the valley of the Rio Grande, and in this district are fully seven-eighths of the inhabitants.

The mineral productions are gold, silver, copper, iron, and lead. The agricultural products are coffee, cacao, sugar, Indian corn, black beans, rice, potatoes, and bananas. The chief exports are coffee, bananas, hides, India rubber, dyewoods, and gold. The imports are all kinds of dry goods, hardware, provisions, drugs, railway materials, and machinery.

The metric system has been in use since 1886. The currency is colons or paper dollars.

A railway connects Port Limon, on the Atlantic, with San Jose, the capital, and continues then to San Domingo de San Mateo, 46 miles. A line of railway about 12 miles long connects Punta Arenas on the Pacific with Esparta, and the construction of the Inter-Oceanic Railway has been resumed. The cart road between San Domingo and Esparta has been put in order, and it is now possible to make the journey from Punta Arenas to the capital, or vice versa, in one day. The Northern Railway from Limon to the banana district of Zent has been completed and opened for traffic.

There is a considerable mileage of telegraph and telephone wires in use.

The Republic of Panama is the southernmost of those countries coming within the scope of this work. It comprises the whole of the Isthmus of Panama, and lies between Costa Rica and Colombia. It owes its importance chiefly to a favorable geographical location where inter-ocean transit was feasible by railroad and later as the practical route of the Panama Canal.

Republic of Panama was formerly a department of the United States of Colombia, but seceded from that country in 1903. A strip of territory approximating 5 miles on either side of the Panama Canal, excepting the cities of Colon and Panama, comes under the jurisdiction of the United States of America.

This Republic has an area of 31,571 square miles, with a population of about 426,928 in 1912 (including Canal Zone).

Winds and weather.—The general system of winds of the North Pacific will be best understood by referring to the high-pressure system which is constant between the coast of California and Oregon, and the Hawaiian Islands. Round this system the winds are anticyclonic, and the consequence is that the winds are as described below. The small variations are doubtless due to the shifting of this high-presure system with the seasons, as although it is constant the area it occupies is liable to modification.

Across nearly the whole of the North Pacific Ocean, between the Equator and the parallel of 20° N., there is generally found a wind from a direction varying between north and east. This wind, from its soft mild nature and its striking resemblance to the wind found in the same latitudes of the Atlantic, has been known as the northeast trade wind from the time of the early circumnavigators. It is, how-

ever, by no means so strong or steady as the trade wind of the Atlantic; its limits are narrower, and its direction is more easterly, inclining at times even to the south of east.

Toward the American cost the trade wind extends much farther to the north than it does in midocean; it is also more northerly in its direction, coming round often to north and even to the west of north. On the coast of California, from a latitude of 40° N. southward for 10° or 15°, a wind from the northwest, or nearly parallel to the coast, blows pretty steadily during the greater part of the year.

During the winter months this northwesterly wind is not found quite so far to the northward; but it stretches down the coast at that season, often nearly to the line, and pretty constantly as far as 10° or 15° N. In summer, on the other hand, it gives place in the lower latitudes to a southwesterly or southerly wind. At Mazatlan and San Blas, for instance, the southerly wind begins in June and ends in October; like the southerly monsoon on the coast of China, it is accompanied by much rain, does not blow steadily, is interrupted by frequent squalls from different points of the compass, and generally winds up with a violent and dangerous storm.

To the northward of 40° N. the mean direction of the winds for the whole year is about due west, inclining to the north of west during the summer, and to the south of west during the winter months. These westerly winds stretch back the whole way across the Pacific, and when well clear of the American coast extend from the parallel of 30° N. to the farthest north. In this area, however, as in the corresponding belt of the Atlantic, cyclonic winds revolving round a low barometer pass from west to east, and cause great temporary variations in the direction and force of the winds; the actual wind experienced will depend upon whether the central depression passes north or south of a ship, giving her in the first case westerly winds, and in the second easterly. As the more ordinary track of the depressions appears to be along the line of the Aleutian Group, the prevalent winds south of these islands are from the western quarter.

On the coast of Alaska the mean direction of the wind is more southerly, and even southeasterly, from which quarter, to the northward of Sitka, they blow persistently through the winter months; but farther to the south they prevail from the southwest, and form a current of soft warm air to which Vancouver Island and the adjacent coasts owe the mildness of their climate.

Between the westerly winds and the easterly or trade winds there is an intermediate region where the wind has no very settled direction. This may be considered as lying for the most part between the parallels of 20° N. and 30° N. In the summer the trade wind extends somewhat farther to the north. In the winter the westerly wind is found farther to the south; but at all seasons there is, between the two, a

space where the wind can not be in any degree relied on, where winds from opposite quarters, sharp squalls or calms, alternate in the most baffling succession. On this account ships going east or west should avoid trying to change their longitude between these parallels, but should keep to the northward or southward of these limits, where they can almost count on having a fresh, fair wind.

It will be noticed, however, that this unsettled region does not extend across the Pacific Ocean from shore to shore. On the east, near the American coast, the northerly winds are felt far to seaward, for a distance which is perhaps, on the average, not less than 10 or 12 degrees of longitude. On the west the alternation of the monsoons is clearly marked as far north as the parallel of 30° N., and reaches, without any decided break, into the line of the prevailing west winds.

Coast winds.—On the coast of Veragua, from Panama Bay to the Gulf of Dulce, the winds depend on the seasons. Toward the end of December the northers set in; these are fine, dry breezes generally beginning in the afternoon and lasting till midnight, blowing very fresh from north-northeast to north-northwest with a clear, cloudless sky, and the air so rarefied that objects on a level with the horizon are distorted and flattened. Generally they blow as a double-reef topsail breeze, but sometimes much stronger, obliging vessels to close reef. During even the strongest of these breezes a dead calm often prevails 10 or 15 miles off the land, the only indication of the gale blowing within a short distance being the agitation of the sea, which is raised in short, hollow waves.

Toward the beginning of April these northers begin to fail, and are succeeded by calms and land and sea breezes, with occasional squalls from the southwest. As April advances the squalls become stronger and more frequent, and in the beginning of May the rainy season is established and continues till November, during the greater part of which south and south-southwest winds prevail with bad weather, gales with thunder and lightning being frequent and at times violent.

From the Gulf of Dulce to the Gulf of Fonseca, the winds still vary with the seasons, modified, however, by locality. Thus, for example, whenever northerly winds prevail, they blow at nearly right angles to the direction of the coast; thus off the coast of Nicaragua, they blow from north-northeast to east-northeast and east; these breezes are called locally Papagayos. The prevailing winds, however, of the dry season, from January to April, are from southeast to northeast.

From the Gulf of Fonseca to the Gulf of Tehuantepec, the northers are not met with till the latter gulf is reached, when they appear again under the name of Tehuantepecers, and are more violent in character. Along that portion of the coast of Salvador, Guatemala,

and Mexico, where the mountains approach, and even in some places form the coast line, the winds during the fine season (from January to April) are the usual tropical land and sea breezes, the former blowing from northwest, the latter from south, varying to west-southwest and west. The other months of the year are marked by bad, stormy weather, and winds from the same quarters as on the Nicaraguan coasts, viz, from west and southwest.

From the Gulf of Tehuantepec to Tejupan Point, as along the whole coast of Mexico, during the rainy season from April to September, the weather is very bad; gales and strong breezes from southeast to southwest constantly occur, while squalls accompanied by thunder and lightning, with heavy and almost incessant rain, characterize the season throughout. During the fine season, however, nowhere is weather so uniformly fine and uninterrupted as on this coast of Mexico; a regular sea breeze sets in about noon, beginning from south-southwest to west-southwest and getting more westerly as the sun goes down, decreasing with it and gradually sinking into a calm as the night closes in; this is succeeded by the land wind, which is less regular in direction and force.

When the coast trends northward again, as it does about Tejupan Point, northerly winds are again found blowing down the Gulf of California, and are very steady, during the fine season, a few miles off the coast. A vessel taking advantage of these winds and of the daily variation in their direction caused by the alternate land and sea breezes can make her passage from this point to San Blas or Mazatlan, but it is always a tedious beat against a lee contrary current, with frequent calms.

Along the cost of Lower California, or from latitude 23° to 32° north, the wind is generally from between west and north, but during the winter months, from November to April, that coast is subject to violent gales from the southeast, which, as most of the bays and anchorages are open toward this quarter, are much dreaded. These gales are less frequent about Cape San Lucas, but toward the northern part of this coast they are more severe; they always give ample warning, however, of their approach. In the summer season the only alteration is that the wind is more westerly in the mornings and draws round with the sun as the day advances. The only way for a sailing ship to make a passage up this coast is by standing off upon the starboard tack; as the offing is gained the wind draws to the eastward, and having made her northing, fetch her port on the other tack.

On the coast of Upper California the wind prevails from the northwest nearly all the year round. This coast is subject to the same southeasterly gales as the coast of Lower California but they are more frequent here and blow with greater force. Off Conception

Point gales and strong breezes are so frequent as to obtain for that point the appellation of the Cape Horn of California. These gales are mostly from north to west and frequently blow with great force, especially in the winter, when they sometimes last for three days together without a single cloud until they begin to moderate. A remarkable feature of this coast is the existence of frequent and dense fogs, which during more than half the year render the coast navigation from San Diego northward most unpleasant.

From San Francisco to Vancouver Island the northwesterly are still the prevailing winds and are very constant in June, September, and October; hard gales from all quarters may, however, be expected at all seasons, especially during the winter and equinoctial months. These gales generally begin from southeast to southwest, bringing thick rainy weather with them; after blowing from these quarters for some hours, they fly round to the northward through west, with little other warning than an increase of rain and blow harder than before. During the spring easterly and northeast breezes are more frequent than at other seasons. In the summer westerly winds and fine weather prevail, but from July to the end of August the fogs are so frequent that weeks will sometimes pass without a clear day.

Barometric pressure.—The importance of a knowledge of the distribution of atmospheric pressure, or of the mass of the atmosphere over the globe, in its varying amounts from month to month, is self-evident. Observations teach us that winds are simply the movements of the atmosphere that set in from where there is a surplus toward where there is a deficiency of air; and observations also teach that isobaric maps and maps showing the prevailing winds are in accordance with each other. The wind does not blow directly from the region of high toward that of low pressure, but in the Northern Hemisphere the region of lowest pressure is to the left of the direction toward which the wind blows, and in the Southern Hemisphere to the right of it.

In the Northern Hemisphere the belt of high pressure which encircles the globe crosses the Pacific Ocean to Asia between the latitudes of 20° N. and 30° N., an area of highest pressure in January, 30.15 inches, lying about longitude 140° W., in latitude 30° N., and in July, 30.30 inches, about longitude 150° W., in latitude 35° N. The low-pressure belt lies north of the Equator, and does not vary its position greatly with the seasons; it varies in depth from about 29.90 inches in January to about 29.95 inches in July. Another low-pressure area lies south of Alaska; it is well marked in January, and has then a low center of 29.55 inches; in July this depression has nearly filled up, and the lowest isobar over the Aleutian Islands is only 29.80 inches.

Temperature.—The temperature of the surface waters of the North Pacific Ocean varies with the season, but in the tropical regions the variation is very small. The highest temperature occurs off the Mexican coast, where the mean temperature rises to 85° F. The course of the isothermals closely follows the latitudes, migrating though 10° to 15° of latitude with the seasons, and turning Equatorward on approaching the American coast. This deflection is most marked in August, when it reaches as far south as latitude 30° N., the water off the coasts of California and Oregon being some 4° colder near the coast than it is 100 miles off, while south of latitude 20° N., on the contrary, the water near the coast is 4° warmer than it is 100 miles off. This deflection on the coasts of California and Oregon, which is caused by the cold current from the northwest, gives rise to the frequent fogs that prevail on these coasts in summer.

Currents.—In the North Pacific the general movement of the water is simple. Its great eddy turns from left to right, consisting of an equatorial portion moving from east to west; of a western portion, known as the Japanese Current, which passes the Japanese Islands northeastward; a northern portion traversing the ocean toward Alaska; and an eastern portion flowing along the western coast of North America to the southeast, completing the circuit. There is a notable subordinate eddy turning round from right to left in the Bay of Alaska, and a small, cold, southward current from Kamchatka, and from the Okhotsk Sea toward Japan. No significant supply of cold water comes from the Arctic Ocean through Bering Strait to the Pacific.

The northeast trade drift, starting from the coast of Mexico, occupies a broad band from latitude 10° N. to 24° N., and reaches across the Pacific to the coast of the Asiatic islands; here the main body of it is deflected northward and finally northeastward as the Japan Current; on reaching latitude 50° N. the current deflects again to the eastward. The quantity of water which can escape through Bering Strait is extremely small, and the main body of the Japan Current becomes a constituent part of the easterly drift of the North Pacific, imparting to it not only strength and volume but the high temperature which it bears with it to the opposite shores, and which has a marked influence on the climate of northwest America.

As this easterly current approaches the American coast it turns southward and, strengthened by the prevailing winds, flows along the coast of California; in the winter months it extends in part down the coast of Mexico. In summer, when southerly winds prevail in that locality, this branch is at all times feeble and is often reversed; but the westernmost part of the California current turns to the west on reaching the latitude of Acapulco and, driven by the northeast trade, becomes the beginning of the Northeast Trade Drift.

Caution.—The regularity of currents on the Mexican and Central American coasts can not be depended upon, and different authorities and various reports fail to allow a concise statement as to their character and existence. Navigators are therefore cautioned to give an ample berth when passing points or making landfalls along the whole of this coast.

Close inshore is a counter eddy current, generally known as the Davidson Inshore Current, which flows northwestward from Point Conception, and follows the trend of the coast, causing at times tide rips close inshore. Its velocity is largely influenced by prevailing winds, and at times its direction is reversed, to be resumed upon moderation of the weather. A continuation of this current sets along the outer coast of British Columbia and southeast Alaska.

The Equatorial Counter Current is a somewhat irregular stream, setting toward the east, between the northeast trade drift and the Equatorial Current, and carrying a body of warm water to the coast of Central America. Though the limits of the counter current are imperfectly defined, it appears to be comprised between the Equator and the parallel of 8° N.; its greatest width is never more than 5° of latitude, and it generally keeps between latitudes 5° N. and 8° N. The velocity of the stream appears to be from half a knot to 2 knots an hour. The Equatorial Current is very strong in places, and has been recorded as running at a velocity of over 4 knots an hour.

Tides.—The observations on tides on the coasts of Central America and Mexico are neither numerous enough nor complete enough to permit of accurate generalization being made for those seas. The times of high water at full and change of moon are given as they were observed or the lunatidal interval as given in the General Tide Tables published by the United States Coast Survey. These tide tables give the predicted time and height of the high and low waters for every day in the year for Panama and San Diego, Cal. Predictions are also given, by means of tidal constants, for intermediate ports, including nearly all the ports and harbors of Mexico and Central America.

Communications—Railways.—In Central America and Mexico the railways having their termini at the Pacific coast ports are mentioned in the description of those ports in the body of this work. The only port on the Pacific coast in connection with a main railway system is Guaymas, which the Sonora Railway connects with the United States Southern Pacific Railway at Nogales.

PASSAGES.

PANAMA TO CENTRAL AMERICA.

Full-powered steamers.—Direct.

Auxiliary-powered and sailing vessels.—The passage to ports along the coast of Central America is slow and troublesome to a sailing vessel; advantage must be taken of every shift of wind to get to the northwestward. The currents will be with the ship as far as the Gulf of Fonseca, when the Mexican stream will be fairly met, and if bound to Acapulco or Mazatlan, the passage may be better made by standing off from the coast, after reaching Fonseca.

The return passage along the coast is much easier between December and May; keeping in sight of the coast insures a fair wind the whole way. In other months of the year the coast should be avoided.

PANAMA TO SAN FRANCISCO AND JUAN DE FUCA STRAIT.

Full-powered steamers.—Direct as possible.

Auxiliary-powered vessels should set a 287° course, passing the meridian of Acapulco in latitude 13° N. The eastern limit of the northeast trade wind is uncertain, but it will generally be met with in about longitude 103° W., that is, at about 300 miles from the land. When first falling in with it the course should be maintained, as by steering more to the northward the trade wind will be found to hang more to the north and northwest. The meridian of 110° W. should be crossed in latitude 14° N., after which steer to cross the one hundred and thirtieth meridian in about latitude 30° N., when steer northward until the westerly winds are reached, and then gradually edge away for the port.

Sailing vessels.—A vessel unaided by steam power will experience considerable difficulty and delay in getting out of Panama Bay, on account of the light baffling winds and calms that are met with there at all seasons. Between October and April the prevailing wind in the Gulf is from the northward; for the remainder of the year the wind hangs more to the westward, and land and sea breezes are felt, varied by calms and occasional squalls from southwest. Northward of latitude 5° N., between the eightieth and the one hundred and tenth meridians, is a region of calms and light winds, varied by squalls of wind and rain; but southward of latitude 5° N., between the mainland and the Galapagos Islands, west of the meridian of 80° W., the wind is between south and west all the year round, and except between the months of February and June is fairly strong.

A sailing vessel should, therefore, at all seasons make the best of her way to the southward into the southeast trade wind. Pass northward of the Galapagos Islands, keeping on the parallel of latitude 2° N. until the meridian of 105° W. is reached, when edge away to pass westward of Clipperton Island, in the neighborhood of which the northeast trades will be met with, when stand to the northwest to cross the parallel of 20° N. in longitude 120° W.; thence if bound to San Francisco, stand to the northwestward as far as latitude 35° N. in longitude 135° W., but if for Juan de Fuca Strait keep on to the northwestward as far as 40° N. in longitude 138° W.; then haul in for the coast as the wind allows, rememoering always to make the land northward of the desired port.

MEXICO TO CALLAO.

Full-powered steamers.—Direct.

Auxiliary-powered vessels should always approach the land near Cape San Francisco. Their steam power will help them both in the first part of the voyage and while beating up to Callao beyond Capes San Francisco and Santa Elena.

Sailing vessels.—The western route seems to be undeniably better from Mazatlan, San Blas, or Acapulco. If from farther south, Istapa or Realejo for instance, there may be some doubt as to which is the better route; but even then it would seem that the westerly passage is to be preferred. The southeast trade will be found to the southward of 10° N., when a vessel may haul up a little free on the port tack and pass a trifle west of the Galapagos Islands.

Vessels taking the inshore route can hardly expect to make the passage from San Jose de Guatemala to Cape Blanco in less than 15 days, and the whole voyage to Callao in less than 35 days.

LOWER CALIFORNIA TO THE NORTHWARD.

All steamers, as direct as possible, keeping within 15 miles of the land.

Sailing vessels.—The only way to make a passage from any part of this coast to the northward is to stand out to sea on the starboard tack until the variables are reached, probably in 130° W., and then make northing, as above directed. From July to January vessels may have to stand out as far as 140° W.

SAN DIEGO, SAN FRANCISCO, AND JUAN DE FUCA STRAIT TO PANAMA.

Full-powered steamers, as direct as possible.

Auxiliary-powered vessels should cross latitude 20° N. in longitude 109° or 110° W., and go down the Mexican coast with the prevalent northwest winds, steaming when becalmed. It will be to their advantage to cross latitude 10° N. in the neighborhood of longi-

tude 90° W., but they will afterwards encounter southeast and south winds, these being often variable and light; steam must be used to reach Panama.

Sailing vessels making this passage between the months of December and May, inclusive, when the prevailing winds on the coast of Mexico are from the northward and the current favorable, should stand down the coast of California, keeping about 100 miles off, and at about 150 miles off the coast of Mexico, shaping a course to make the island of Jicaron, which is a good landfall for vessels bound to Panama from the westward.

Between the months of June and November, inclusive, when calms. variable winds, and oftentimes hurricanes prevail on the Mexican coast, vessels should stand well out to sea after passing San Francisco, shaping a course to cross the Equator not eastward of longitude 104° W., thence standing on the southward until sure of reaching Panama on the starboard tack.

SAN DIEGO AND SAN FRANCISCO TO SOUTH AMERICAN PORTS AND CAPE HORN.

Full-powered steamers, as direct as practicable.

Auxiliary-powered vessels should follow the route given to Panama, that is, keep nearer the Mexican coast, crossing latitude 10° N. in longitude 90° W., and making the coast of South America near Cape San Francisco; they will experience variable winds till they reach this cape, and will have to use steam about half the time in this locality. The passage from Cape San Francisco to Callao will be tedious, as both wind and current are from the southward.

Sailing vessels, on getting an offing from San Francisco, should steer south, endeavoring to cross the Equator near longitude 118° W. between May and October, and near 113° W. between October and May. On reaching the southeast trades, stand on the southward until the west winds to the southward of 30° S. are reached, then bear away to the eastward until the port of destination bears to the north of northeast, when shape a course in for the land, in all cases making the land southward of the port. Ships bound round the Horn should steer south until they have settled and steady west winds, when they can gradually bear away to the eastward.

SAN DIEGO AND SAN FRANCISCO TO HONOLULU.

Full-powered steamers, as direct as possible.

Auxiliary-powered vessels.—Steer southwestward into the northeast trade, and then direct to destination.

Sailing vessels.—On leaving San Francisco run to the southward and westward for the northeast trades, and from June to December

clear the coast as soon as possible, steering about 264° to avoid the calms eastward of longitude 128° W. Near the Hawaiian Islands the trades may possibly haul to east or even to southeast, particularly from October to May; the land should be approached from east-northeast, when all possible winds will be fair. When making a landfall, remember that the currents often run at a velocity of 20 miles a day, and that calms and baffling winds are common to leeward of the islands.

SAN DIEGO AND SAN FRANCISCO TO AUSTRALIA:

Full-powered steamers.—As direct as possible, coaling, if necessary at Honolulu and Fiji.

Auxiliary-powered vessels.—As directed to Honolulu, then to Fiji and port of destination.

Sailing vessels.—The course should be first down into the region of the northeast trades; after reaching these steady winds make the following crossings: From January to July, cross latitude 10° N. in 143° W., and the Equator in 148° W. In January, February, and March no calms, properly speaking, will be found between the northeast and the southeast trades. In April, May, and June there will be only about 2 per cent of chances of calms in this region.

In July, August, and September cross latitude 10° N. in longitude 148° W., and the Equator between 150° and 153° W. In this season, if the precaution be taken not to follow a more easterly course than the one indicated, there will be only from 2 to 3 per cent of calms between latitude 10° N. and the line.

From October to January cross latitude 10° N. in longitude 138° W., and the Equator in 143° W. By following this route there are only from 2 to 3 per cent of chances of calms between the two tradewind regions. Farther to the westward at this season the ship would be liable to meet more calms. At all seasons cross latitude 10° S. near longitude 155° W.

The above is taken from "Navigation of the Pacific Ocean," translated from the French and published by the U. S. Hydrographic Office. In the United States Pilot Charts of the Pacific Ocean, however, the track recommended for crossing the Equator is: January and February, longitude 152° W.; March to June, 150° W.; July to September, 152° W.; October and November, 153° W.; December, 152° W.

Coal can be obtained at the following ports: In Costa Rica: Punta Arenas, supply uncertain. In Nicaragua: Corinto. In Salvador: Acajutla. In Mexico: Acapulco, Mazatlan, Guaymas, and La Paz.

Mexican buoyage.—Black buoys and odd numbers signify that they are to be left on the port hand on entering a harbor; red buoys and even numbers must be left on the starboard hand. Buoys painted in horizontal stripes may be passed on either side. As far as possible, all red beacons will be placed to starboard, like the red buoys; and all white or black beacons, to port. Those with horizontal stripes can be passed on either side. Buoys marking the remains of shipwrecked vessels will be painted green.

Mexican lighthouses; distress signal.—Two successive rockets every five minutes is the signal by which the lighthouse keepers call for assistance from passing vessels. The national flag, knotted in the center, is also employed for this purpose, or the letters H. B. of the International code.

Seamen are earnestly requested to render assistance to lighthouse keepers signaling for it, to ensure the greater efficiency of the service, and prevent possible disastrous consequences.

CHAPTER II.

WEST COAST OF THE PENINSULA OF LOWER CALIFORNIA FROM THE BOUNDARY TO SAN EUGENIO POINT, WITH ADJOINING ISLANDS.

Remarks.—From the United States boundary line to Cape San Lucas, the entire coast of Lower California, with the exception of the valleys of Santo Tomas and Todos Santos, is barren in the extreme. The land is in general high and bold, the water deep, and the approaches clear. While there are but two complete and accessible harbors on this coast (Port San Bartolomé and Magdalena Bay), there are many anchorages that afford shelter from the prevailing northwesterly winds; from the occasional southerly gales of winter, the only places besides the harbors mentioned that afford valuable shelter are Todos Santos and Sebastian Viscaino bays and, for small vessels, Hassler Cove.

Winds.—The prevailing winds along the coast are northwesterly, and may be said to blow steadily from that direction for about eight months of the year.

During November, December, January, and February winds from southeast to southwest are frequent, with occasional moderate southeast gales, accompanied by considerable rain. Before the breaking up of these gales the wind hauls to the southwest, sometimes blowing quite hard for a few hours, then comes out from northwest with fine weather. In December and January heavy northers are likely to occur, blowing from north to northeastward and lasting from one to three days. During the summer months strong southeast gales of short duration occur in the vicinity of Cape San Lucas, sometimes extending as far north as Magdalena Bay. Between Abreojos Point and Magdalena Bay neither southeast gales nor northers were experienced during a two year's survey of this part of the coast.

Weather, fogs.—The weather during the greater part of the year is clear and pleasant, and the climate mild, equable, and very healthful. Rains are most frequent between May and October. Fogs occur at all seasons, but chiefly during the summer months, setting in at night or early in the morning and clearing away about 10 a. m., the remainder of the day being clear and pleasant. There is less fog

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south of Cerros Island than north of it, and the weather clears earlier; the temperature is lower and the winds are lighter. From Boca de las Animas to Magdalena Bay fogs are very frequent during the late fall and winter; forming over the lagoons and the bay, they are blown seaward in the early morning by the land breeze and shoreward again by the sea breeze, clearing away at about noon.

Currents.—The currents near the coast set in the same direction as the prevailing winds and vary in strength from ½ knot to 1 knot an hour. Near the land the influence of the tides is also felt; at all times an easterly set should be guarded against. Between Abreojos Point and Magdalena Bay vessels frequently experience in the winter season, at distances of from 15 to 25 miles from the coast, a north-westerly current with a velocity of ¾ to 1 knot an hour.

Navigators are cautioned against the effect of the tidal streams off the mouths of lagoons; during the night or in thick weather, a spring flood setting athwart a vessel's course would be a serious source of danger.

Boundary monument.—The western initial point of the boundary line between the United States and Mexico is marked by a white marble obelisk about 20 feet high, resting on a pedestal and about 41 feet above the sea. The monument stands about 200 yards from the beach, near the edge of a low table bluff, and is plainly visible from seaward. Directly north of it the mesa falls to the low marshy land south of San Diego Bay; to the eastward the land rises and at about a mile in that direction there is a stone mound, 365 feet above the sea, marking a second point of the boundary line.

Position.—As determined in 1871 by the United States Coast Survey, the monument is in latitude 32° 31′ 58″ .46 N., longitude 117° 07′ 32″ .37 W., and is about 10 miles (142°) from Point Loma Lighthouse.

Los Coronados Islets are a group of four high, bold, and barren rocks lying, in their nearest part, 7 miles off the coast and about the same distance to the southward of the boundary, and extending about 5 miles in a northwest and southeast direction.

The southernmost and largest islet is about 2 miles long and ½ mile wide, and rises near the southern end to a height of 672 feet, appearing as a wedge-shaped mass when seen from the northward or the southward. A few small scrubby bushes grow upon it, and during the rainy season it is covered with flowers; in the dry season all vegetation is withered and the islet presents a sterile appearance.

The two central islets, lying respectively $\frac{1}{2}$ mile and $\frac{3}{4}$ mile westward of the north end of the largest islet, are small barren rocks, one of them 251 feet and the other 101 feet high, formerly a favorite resort of the sea elephant. The islet second in size, and the northwesternmost of the group, lying $2\frac{1}{2}$ miles 297° from the north end of

the largest islet, is about a mile long, $\frac{1}{4}$ mile wide, and 467 feet high. The passage between this islet and the others is $1\frac{1}{2}$ miles wide, with from 17 to 50 fathoms of water and numerous patches of kelp.

In approaching San Diego Bay from the south this group makes a good landmark when Table Mountain is clouded; before coming up with them, Point Loma shows plainly as a low flat island. The wide passage between the islets and the mainland has depths through the middle of from 14 to 18 fathoms and is clear and safe, with no hidden dangers.

Anchorage can be found on the east side of the largest islet, a little south of the middle, in 8 fathoms water, sandy bottom, with good shelter from the prevailing wind.

Boats may safely land in a small cove, open to the northward, near the anchorage.

Position.—The highest point of the largest islet, as determined by the United States Coast Survey, is in latitude 32° 23′ 46″ N., longitude 117° 14′ 42″ W., about 16 miles 180° from Point Loma Lighthouse and 10½ miles from the boundary monument.

Coast.—From the boundary monument the coast trends nearly southward 4 miles, then south-southeastward 13 miles to Descanso Point, and is generally bluff, from 50 to 80 feet high. A short distance inland is a range of hills about 400 feet high and behind these a range of mountains, of which Table Mountain is 2,275 feet high, and Sharp Peak, a triple-peaked mountain a few miles south of Table Mountain, is 2,402 feet high. These mountains are easily distinguished and are excellent landmarks in approaching the coast.

Sixteen miles inland is the great chain of the coast mountains which reaches an elevation of 3,291 feet at Double Peak in Mexico and 3,535 feet at a peak in the United States, 3 miles north of the boundary.

Descanso Point is marked by a slight hill on the top of the bluff near its extremity and 392 feet above sea. Four miles northward of the point are a ranch and an arroyo, off which are some outlying rocks a short distance from the shore. Near the coast, on the edge of the high mesa, 1½ miles northward of the point, is a remarkable turret-shaped hill, apparently an old crater.

Descanse Bay is a wide indentation of the coast eastward of Descanse Point. Four miles 132° from the point and 1¾ miles from the shore is Sugarloaf Rock, 13 feet high, the only outlying danger in the bay. There is said to be an anchorage, often used by the small coasters, southward of the rock, and anchorage may be found anywhere along the shore of the bay in from 8 to 15 fathoms, sand bottom. The soundings deepen rapidly offshore, the 100-fathom line being only about 3 miles from the coast. Near the shore, 7 miles southeastward of Descanse Point, is a small settlement, recognizable by

conspicuous sand hills to the northward of it, near which small vessels sometimes anchor.

Sal si Puedes Point, 15 miles 152° from Descanso Point, is low and not well defined. The intermediate coast is generally sandy, with an occasional rocky cliff; high hills rise immediately behind the beach.

The name Sal si Puedes is more appropriately applied to the southern point of the broad, blunt projection of the coast, 5 miles wide, between Descanso Bay and the next bay to the southward; here a vessel first feels the strong northwest wind in passing from the shelter of the bay.

San Miguel Point, the northern limit of Todos Santos Bay, is a bold point, 150 feet high, 11½ miles 142° from Sal si Puedes Point. The intermediate coast consists of alternate sand bluffs and rocky cliffs about 50 feet high, backed by hills from 300 to 500 feet high, and a mountain range more than 3,000 feet in height a few miles inland. Viewed from seaward this mountain range has the appearance of bordering on the coast. Northward of San Miguel Point is a bay formed by an indentation of the coast 5 miles wide and 2 miles deep.

Saucedal Point lies nearly 2 miles eastward of San Miguel Point at the opening of a valley containing several ranch buildings and an arroyo. A reef extends a quarter of a mile southward from the point, and both eastward and westward of the point the water is shoal for a considerable distance offshore. There is a practicable landing place eastward of the point in the small bay made by the curve of the shore to the northward.

Morro Point, 3\frac{3}{4} miles southeastward from Saucedal Point, marks a sharp turn of the coast to the eastward and lies abreast of a narrow valley which leads to the rear of Ensenada. Along the shore between the two points is a large field of kelp, its outer edge in from 10 to 13 fathoms and its southern extremity in 13 fathoms, 1\frac{1}{2} miles southwestward from Morro Point. Breakers have been reported at the inner edge of this kelp and on the line from Morro Point to the westerly end of the Todos Santos Islands.

Vessels should pass outside the kelp, and not attempt to pass between it and the shore.

Ensenada Point is a steep promontory, 370 feet high, and bears 118° from San Miguel Point, distant 6½ miles. The coast between them is bold, with cliffs from 50 to 100 feet high and hills rising behind the cliffs.

From Ensenada Point the coast turns sharply to the northward and then curves to the eastward, making a small bay at the head of which is situated the town of Ensenada. The upper part of the bay is shoal, but small vessels may anchor in from 3 to 5 fathoms

of water, sandy bottom, and find good shelter from the prevailing winds. If anticipating a southern gale, anchorage should be shifted to the southern side of the bay under Banda Point. There is generally an uncomfortable swell at the Ensenada Anchorage.

Vessels are reported to the town from a signal station, with house and flagstaff both painted white, which is located on Ensenada Point, 110 yards within the extremity.

Ensenada, the seat of government of the northern district of Lower California, and a port of entry, is not improving much owing to frequent and continued droughts, which make agricultural pursuits very uncertain. Owing to the general scarcity of water throughout the interior, irrigation systems would be expensive, even if possible. Mining of all kinds is also affected by the scarcity of water, though of late a number of mines have yielded a fair product. Cattle raising is carried on to some extent, and in favorable seasons some wheat is raised. The one flour mill is idle much of the year.

In sanitary matters both town and port are in charge of a Federal health officer and the town is kept clean; there is no hospital.

The town owns a water plant of limited capacity and a similar plant of about the same capacity is owned by a firm of local merchants; both plants are supplied by wells within the town limits. The electric-light plant of about 500 lights is operated by the firm that owns the water plant.

Ensenada Light, fixed red, visible 2 miles, is shown from the end of a pier (see Light List).

The United States is represented by a consul and vice consul.

Quarantine.—A vessel on arrival is boarded by the health officer and no one is permitted to land or to leave her until pratique, which is free, has been granted. Pilotage is not compulsory or necessary.

Supplies.—Provisions and water are obtainable; wood is scarce; there is no coal.

Communications.—The Pacific Coast Steamship Co., under contract with the Mexican Government, operates a mail steamer between San Francisco and Ensenada, Magdalena Bay, San Jose del Cabo, Mazatlan, Altata, La Paz, Santa Rosalia, and Guaymas, giving a monthly service in each direction.

The Lower California Development Co. operates a mail steamer between San Diego, Ensenada, San Quentin, and other points within their land concessions, making six trips a month.

There is telegraphic communication, by way of San Diego, with all parts of the world; the line extends south from Ensenada as far as San Quentin. At Tijuana the line is in connection with the Mexican Federal telegraph system.

Todos Santos Bay.—From Ensenada Anchorage the shore line sweeps around in a rough semicircle to Banda Point, a bold and

rocky headland at the extremity of a long and narrow promontory that forms the southwestern boundary of Todos Santos Bay. Between Banda Point and San Miguel Point the bay is 9 miles wide and within these two points extends 7 miles to the eastward. The land bordering on the southeastern side of the bay is a low sand beach, and an extensive lagoon, the Estero de Punta Banda, lies just within the shore line, extending as far as the highland of the Banda Peninsula. The mouth of this lagoon, which is near its northern end and 5 miles south of Ensenada, is obstructed by extensive shoals on which the sea breaks continually. The low flat shore ends at the extreme southern limit of the bay; thence to Banda Point is a continuous bluff, from 40 to 140 feet high, back of which the land rises to a general elevation of 700 to 800 feet, and in Banda Peak, 1 mile within the point, attains a height of 1,264 feet. Along this southwestern shore there are numerous detached rocks and patches of kelp; a ragged ledge extends about 1 mile northwestward from Banda Point, the water being bold and clear in close proximity, although its whole appearance is suggestive of foul ground.

Rock.—A rock with a least depth of 3 fathoms has been reported about 2½ miles northward of the smaller of the Todos Santos Islands.

Anchorage.—In the extreme southern part of the bay, 4 miles from Banda Point and just at the end of the cliffs, there is a low sand beach, flanked on the south and west by hills 500 feet high, near which is the site of an old whaling station. In this bight of the bay there is good and comfortable anchorage in from 3 to 10 fathoms, sand and mud bottom. The prevailing northwesterly wind in its usual force is not seriously felt here, and for southerly gales it is the best anchorage to be found on the coast outside the harbors.

Tides.—The mean lunitidal interval for high water in Todos Santos Bay is 9h. 28m.; the mean rise and fall of the tide is 5 feet.

Todos Santos Islands, fronting the bay, lie in the continuation of the Banda Promontory, with which they are in fact connected by a remarkable submarine ridge. The southern and larger island, 3 miles from Banda Point, is 1½ miles long, ½ mile wide, and 313 feet high; the smaller, a low flat island northwestward of the larger and separated from it by a boat passage, is ½ mile long, ½ mile wide, and 55 feet high. Both are barren and surrounded by detached rocks and kelp. Off the northern shore of the smaller island a field of kelp extends about a mile to the northward, its outer edge being in about 20 fathoms. Anchorage may be found in good weather on the northern side of the larger island, in 10 fathoms, sand bottom, but is not to be recommended.

The channel separating the islands from Banda Point is 2 miles wide, very deep, and free from danger. A line drawn from Banda

Reef to the nearer island follows through its entire length a submarine ridge, the lowest part of which, in mid-channel, with a depth over it of 128 fathoms, is about 500 feet above the sea bottom at a distance of $\frac{1}{4}$ mile on either side.

Soledad Bay, just north of the Santo Tomas Promontory and 11 miles from Banda Point, is made by an indentation of the coast about 1 mile in width and depth. While the bay is clear of outlying dangers and affords convenient depths for anchorage, it offers no inducements for a visit; communication with the interior would be difficult; there is no fresh water; the prevailing coast wind blows directly into the bay, and a southerly gale hauling to the westward would bring in a heavy sea.

Soledad Rocks, lying 1½ miles westward of Santo Tomas Point, are a small group of rocks, 20 feet high, whitened by the birds, surrounded by kelp, and with deep water close around them. The channel between the rocks and the point may be safely used by keeping clear of the kelp on either side.

Santo Tomas Point, 12 miles 166° from Banda Point, is the southwest corner of a square-shaped headland that projects about 1½ miles westward from the general coast line. The intermediate coast curves to the eastward and is high and precipitous, with deep water close to the shore, which is lined with kelp and numerous detached outlying rocks. The mountains rise abruptly in a group of peaks more than 3,000 feet high, the highest being 3,566 feet high.

At its extremity the point is low and rocky, but in a distance of $\frac{3}{4}$ mile the land attains a height of 395 feet, and in Bluff Peak, 1 mile northeastward of the anchorage, a height of 1,450 feet. The entire headland is surrounded by kelp, which extends on the northern and western sides nearly half a mile from the shore, its outer edge following in general the 10-fathom curve. A sunken rock on which the sea breaks lies $\frac{3}{8}$ mile 326° from Santo Tomas Point; there are no other known dangers outside of $\frac{1}{4}$ mile from the shore.

Santo Tomas Anchorage, a small bight to the eastward of the point, affords good anchorage in from 5 to 10 fathoms, sandy bottom, sheltered from the prevailing coast wind. It is the shipping point for the village of Santo Tomas, which is situated in a fertile valley 11 miles from the anchorage and connected therewith by a good road. The Santo Tomas River furnishes a good supply of water for the village, but as it approaches the coast disappears in the porous soil, as do most of the rivers of Lower California. In the winter season it generally reaches the coast as a running stream, the mouth of which is about 1 mile from the anchorage. Throughout the valley, wherever water can be had for irrigation, the fruits of the Tropics and of the Temperate Zone flourish side by side, requiring but little care beyond a supply of water. An abundance of small game, such

as ducks, quail, and snipe, was found in the winter season near the banks of the river.

Near the anchorage there are no buildings, the old whaling station having disappeared; no fresh water has been found excepting that of the river.

Tides.—High water at full and change is at 9h.; the mean rise and fall of the tide is about 4 feet.

Directions.—To make the anchorage from the northward or the westward, give to Santo Tomas Point and the land to the southward and eastward a berth of from a quarter to half a mile in order to avoid the dense masses of kelp; stand to the eastward until a small sand beach, the landing place, with a few outlying rocks at its southern end, is open to the northward of the inner point; then haul up to the northward and on shutting in the Soledad Rocks anchor at once in 7 to 8 fathoms, sand bottom, within ½ mile of the landing place.

Coming from the southward there are no outlying dangers; steer for the deepest bight until the small sand beach is made out and then proceed as above. A large vessel should anchor farther out, with the Soledad Rocks open of the point.

San Jose Point lies 7 miles southeastward of Santo Tomas Point, the intermediate coast being a succession of bluffs backed by hills and small mesas. A great field of kelp extends about 2½ miles off the point, and in the kelp nearly a mile southwest of the point is a shoal patch of 5¾ fathoms. The point affords good protection from the prevailing wind, but the anchorage is much obstructed by the kelp.

Coast.—From San Jose Point the coast trends southeastward 24 miles, and thence with a sharp turn southward 12 miles to Cape Colnett. It is a succession of broken bluffs and low beaches, backed by small mesas and these again by the mountains of the coast range, about 2,000 feet high, as far as the Colnett Plateau, which begins abruptly 8 miles north of the cape; the seaward face of this plateau is a line of perpendicular cliffs which extend around the cape almost without a break; on the landward sides also the cliffs rise abruptly from the low adjoining plains.

Near San Isidro Point, 21 miles below Santo Tomas Point and the same distance northward of Cape Colnett, behind the larger of two detached rocks, so whitened by the birds as to be visible 5 or 6 miles, is a good landing place for boats; from here a road leads to the old mission of San Vicente, 7 miles inland. Although the mission is practically abandoned, there are many evidences of former thrift in the extensive ruins of the mission buildings, the famous grove of olive trees, and the hedges and irrigating ditches that wind around the hills and through the valleys.

A rocky patch lies 1,200 yards from the shore, just above the mouth of the San Isidro River; this and the 5\frac{3}{4}-fathom patch off San Jose Point are the only known outlying dangers from Santo Tomas Point to Cape Colnett.

Cape Colnett is a remarkable headland of semicircular form rising abruptly from the water in perpendicular cliffs to a plateau from 300 to 400 feet high. On a base of light sandstone more than 50 feet above the water lies a strata of broken rock, nearly black and strongly resembling coal, this strata being covered with sand. From the northward or the southward the height and sharp outline of the cape make it visible at a great distance.

Colnett Bay, to the eastward of the cape, affords a spacious anchorage with more than the usual protection from the prevailing wind. The usual anchorage is abreast a remarkable gorge in 6 to 9 fathoms, sand bottom, the gorge being a convenient point to steer for in the approach. The best landing place is at the meeting of the cliffs and the shingle beach.

The anchorage under Cape Colnett is subject to heavy squalls, which sweep down from the cliffs without warning, while offshore a moderate and steady northwest wind is blowing, and even on top of the plateau there is no indication of a disturbance.

Off the mouth of the San Telmo River at the southern limit of the bay, shoals bordered by patches of kelp make off 3 mile from the shore.

San Ramon Bay.—From Colnett Bay the coast trends southeastward 9 miles to Camalu Point, and thence nearly south 20 miles to the cliffs opposite San Martin Island, forming San Ramon Bay. The land is lower than north of the cape, consisting of sand hills and bluffs backed by low mesas as far as the San Ramon River, and thence of a low sandy shore, behind which is a lagoon and the plain of Santa Maria, which extends back of the San Quentin Hills to the shores of the bay.

For some 15 miles from Colnett Anchorage fields of kelp make off from the shore 3 or 4 miles; thence to the vicinity of San Martin Island the coast is clear. The water is shoaler in this bight of the coast than to the northward of Colnett, but with the exception of two 43-fathom spots, respectively 14 miles southward and 24 miles northwestward from San Jacinto Point, there are apparently no outlying dangers.

Fifteen miles from Cape Colnett is the mouth of the San Ramon River, in the valley of which, 5 miles inland, is the old mission of Santo Domingo. There is a boat landing under San Jacinto Point.

Calamahue Mountain.—Eastward of San Ramon Bay, 37 miles from the coast, is Mount Calamahue, 10,126 feet high, sometimes

called Santa Catalina from the old mission of that name near its base. This mountain, the highest in Lower California, is near the middle of the peninsula, being 28 miles from the Gulf coast; it has a whitish appearance and a jagged top and can be seen in clear weather from a distance of more than 100 miles. During the winter and spring it is covered with snow.

San Martin Island lies 30 miles 159° from Cape Colnett, and is nearly circular in form, with a diameter of about 1 mile. Near its center are two remarkable peaks, of which the southern, an extinct volcano 497 feet high, has a crater at its summit 350 feet in diameter and 40 feet deep. The island is quite barren, producing only the prickly pear and a few stunted bushes that grow among the loose masses of lava; it is surrounded by kelp and detached rocks, and is the resort of great numbers of seal and sea fowl, which are particularly numerous on the shores of the cove and the lagoon.

Anchorage may be found on the southeast side of the island, off a small lagoon that communicates with the sea at half tide, or anywhere on the northeast side. The best anchorage for small vessels is in Hassler Cove, a small bight on the eastern side, in 7 to 9 fathoms, the outer end of the natural breakwater that forms the east side of the cove bearing 123°; during a southerly gale an anchor should be dropped under foot to guard against a change of wind to the northwestward. The sand beach of the cove offers a good landing place.

The passage between San Martin Island and the mainland is $2\frac{1}{2}$ miles wide, with from 10 to 15 fathoms of water, and is free from danger.

Ben Rock, a dangerous rock with from 9 to 12 feet of water over it, lies 2\frac{1}{5} miles south of San Martin Island and 4\frac{1}{5} miles from the mainland. From the rock, San Martin south peak bears 358° and Mount Ceniza, just open to the southward of Southwest Hill, 86°. There are 11 fathoms close to the rock and 25 fathoms 200 yards from it; no kelp surrounds the rock, and in moderate weather the sea breaks on it only occasionally.

Discolored water of a brownish hue was reported in 1903, 6 miles 253° from Cape San Quentin. A breaker that gave the appearance of being over a rock rather than over a shoal was observed in this position in 1914. No discolored water was seen. A long, heavy northwest swell existed at the time.

Coast.—At the southern end of San Ramon Bay, and nearly abreast of San Martin Island, the coast rises suddenly in a perpendicular cliff of dark-colored rock, which extends 2½ miles to the southward; thence the coast is a low sand beach for ½ mile, and then bold rocky cliffs to Southwest Hill, one of the five hills of the early navigators, 380 feet high, and bordering directly on the sea. From Southwest Hill there is again a low sand beach for

3½ miles, and then as far as Cape San Quentin a low and rocky shore with numerous projecting points and low outlying rocks on which the sea breaks heavily.

Cape San Quentin is the southeastern extremity of a long narrow peninsula that forms the western side of the San Quentin Lagoon. Just below Southwest Hill the peninsula is only a few yards wide, but near its southern end attains a width of 1½ miles and an elevation in Mount Mazo of 160 feet. On the western side, abreast of Mazo, are two rocky points, one of them called Reef Point, off both of which extend reefs a quarter of a mile seaward. Afuera Point, the southernmost point of the peninsula, lies a quarter of a mile to the westward of Cape San Quentin and between the two is a narrow strip of sand beach.

From the cape the low rocky beach continues for a little more than $\frac{3}{8}$ of a mile to the northward and eastward, thence to Entrada Point is a low sand beach with two outlying rocks 300 yards southwest of the point.

Entrada Point, about § mile northeastward of Cape San Quentin, is a low rocky point, with no outlying dangers; it may be approached from the eastward to within 200 yards by a vessel drawing 18 feet; from any other direction it should not be approached within a quarter of a mile. Five-eighths of a mile northwestward of Entrada Point is Sextant Point, which is low and sandy; and ¾ of a mile farther in the same direction is Rocky Point, which is conspicuous in contrast with the intervening low sand beach. In the bight beyond Entrada Point the water is very shoal, but being much protected from the swell, the bight affords a fair landing for boats.

From Rocky Point there is a sandy beach backed by a succession of low sand hills as far as Laguna Point, 1½ miles to the northward; this point and Sulphur Point, the opposite low sandy point ¾ of a mile to the southeastward, mark the entrance to the San Quentin Lagoon.

Port San Quentin affords to very small vessels a perfectly secure anchorage, protected on all sides. The entrance is obstructed by extensive shoals, across which there appeared to be, in 1886, a difficult low-water channel of 2½ fathoms; the large water area within consists mostly of sand and mud flats, dry in patches at low-water springs, through which winds for several miles a narrow channel with from 3 to 6 fathoms of water. The land in the vicinity is low and sandy, and with the exception of cactus and a few stunted bushes, entirely without vegetation; no fresh water can be found near the coast.

The salt mine, situated about 1½ miles from the head of the lagoon, is said to be, in quantity and quality, one of the three best in Lower California. A limited quantity of the product was formerly sent

to San Francisco, but the business was not profitable, owing to the difficulty of transportation and the greater accessibility of other sources of supply.

The old village of San Quentin, laid down on the coast chart, is believed to be deserted; but there is a new settlement of the Lower California Development Co. on the shore of the lagoon, some miles above Sulphur Point; from here a small steamer belonging to the company runs regularly to Ensenada and San Diego, to which places there is also a line of telegraph.

The five remarkable hills, from 380 to 876 feet high, to the northward of the port, which have the appearance of islands in approaching from that direction, caused one of the early navigators to name it the "Bay of Five Hills."

Caution.—No vessel should attempt to enter Port San Quentin without first sending a boat in to sound and buoy the channel, which is narrow and tortuous and liable to change with every southerly gale.

The channel to San Quentin was reported in 1903 to be marked with spar and barrel buoys, maintained by the Lower California Land & Development Co.

Tides.—High water in San Quentin Bay, at full and change, is at 9h. 19m.; the mean rise and fall of the tide is 4 feet.

Observation spot of the U. S. S. Ranger is about 1 mile from Entrada Point, in latitude 30° 21′ 53″ N., longitude 115° 59′ 06″ W.

Bank.—About 5 miles 278° from Cape San Quentin, and outside the 50-fathom curve, is a small rocky bank, showing a least depth of 15 fathoms; between the bank and the coast, 4 miles distant, the water is deep and the soundings are regular.

San Quentin Bay, eastward of the San Quentin Peninsula, is spacious and affords good shelter from the prevailing wind, but a long swell usually rolls in and makes the bay an uncomfortable anchorage. Shoal water extends a considerable distance from the head of the bay, but there are no outlying dangers.

The shore of the bay is a low sand beach, with hills about 300 feet high rising a short distance inland, and these backed by a mountain range from 1,500 to 3,000 feet high. About 10 miles from Cape San Quentin, where the coast line assumes a southerly direction, its character changes; sand bluffs and dark-colored cliffs, 50 to 100 feet high, alternate for several miles and gradually decrease in height as they approach Baja Point.

Baja Point, 264 miles 160° from Cape San Quentin, is a low sand cliff about 30 feet high. On its seaward face are numerous outlying rocks, and a reef surrounded by kelp makes off a short distance to the southward of the point, which should be given a good berth by vessels entering Rosario Bay. Six miles to the northward of the point, in

a small indentation of the coast, between a dark-colored hill, 349 feet high, and an arroyo, there is a ranch and 2 miles inland from here is the old mission of Rosario.

Rosario Bay, eastward of Baja Point, is formed by a curve of the coast to the northward, and is so called from the old mission of Rosario, situated in a fertile valley a few miles inland. Shoal water extends a considerable distance from the shore, and the bay is much obstructed by kelp; but good anchorage may be found in from 5 to 6 fathoms, sandy bottom, sheltered from the usual coast wind. A prominent white spot on the range of hills, 13 miles northeastward from the shore of the bay, is a convenient object for bearings.

From Rosario Bay to Point Antonio, 15 miles, the coast consists of sand bluffs 50 to 100 feet high, with hills from 300 to 500 feet high from 1½ to 2 miles inland, and is broken by several canyons, of which the most conspicuous are those of San Vicente and San Antonio. San Vicente Peak, 1,511 feet high, rises 3 miles from the coast.

San Geronimo Island, lying 9½ miles 174° from Baja Point and 5 miles off the coast, is a barren rock covered in many places with a mixture of sand and guano, ¾ mile long and less than ⅓ mile wide, with rocky shores, and cliffs 10 to 20 feet high. Near the center is a hill 130 feet high, and northward of this are two lower hills. The island is surrounded by kelp and outlying rocks, and a reef extends ¾ mile southwestward from the southern end, its termination being marked by a rock 15 feet above water, against which the sea breaks heavily. Seal and birds resort to the island in great numbers.

Stretching southward from Rosario Bay toward the island is a great field of kelp, in which are numerous rocky shoal patches. One of these, with 3 fathoms over it, on which the sea breaks occasionally, lies 4 miles 154° from Baja Point; another, with 3½ fathoms, lies 2½ miles 15° from the island; a third, with 6 fathoms, lies 1¾ miles 27° from the island. Other patches, equally shoal, may exist, as the bottom is rocky and irregular. The outer edge of the kelp follows in general the 10-fathom curve. There is a lane of open water about 1 mile wide, with from 13 to 15 fathoms of water through the middle, between the tail of this kelp field and that extending off the north side of the ilsand.

A sounding of 37 fathoms has been obtained to the westward of San Geronimo Island in, approximately, latitude 29° 48′ 15″ N., longitude 116° 02′ 30″ W. This position is outside the 100-fathom curve.

Tides.—The mean lunitidal interval for high water is 8h. 44m.; for low water, 15h. 31m.; the mean rise and fall of the tide is 6.4 feet.

Anchorage may be found to the eastward of the island in about 7 fathoms, sand bottom, well sheltered from the prevailing wind; an uncomfortable swell will sometimes be felt. There is a good landing place on a small shingle beach in a slight indentation of the shore line of the southeast side of the island, at the base of the highest peak. Vessels will reach the anchorage more comfortably by passing south of the island, but may go out to the northward by keeping clear of the kelp, using the lane of clear water mentioned above.

Sacramento Reef, a very dangerous reef, lies southeastward of San Geronimo Island and westward of Point Antonio and is directly in the track of vessels making the passage northward by keeping close along the coast. The reef is approximately a horseshoe in shape, the opening, with depths of 8 to 9 fathoms, lying toward Point Antonio and covers an area of about 2½ miles long from northwest to southeast by 1½ miles wide; the 10-fathom curve closely skirts the reef; there are numerous large rocks awash and above water, and the entire reef is a mass of breakers.

The passage between the reef and the island is 2 miles wide, with depths from 11 to 15 fathoms in the middle, and that between the reef and the point is 3 miles wide with 7 to 11 fathoms through the middle; in these passages are large dense masses of kelp, which should always be avoided if practicable, as there are many rocky patches in this vicinity, and shoal spots may exist that were not developed by the survey. There is a 3-fathom spot in one of these rocky patches $2\frac{\pi}{2}$ miles west of Point Antonio and $\frac{\pi}{2}$ mile from the reef; with the exception of the shoal water extending $\frac{\pi}{2}$ mile off the point there are no other known dangers in this passage.

Coast.—From Point Antonio to Canoas Point, 33 miles, the coast has a general trend of 128°, but with a succession of curves to the eastward at San Fernando, San Carlos, and Bluff Points, respectively, under each of which points, though the water is shoal, an anchorage may be had with some protection from the prevailing wind; of these anchorages the San Carlos is the best. The coast retains its character of sand bluffs from 50 to 100 feet high, and is backed by moderately high hills and in some parts by table-lands from 1,000 to 2,000 feet high, with numerous peaks; of these, Sombrero Peak, 1,893 feet high, 2½ miles northeastward from Bluff Point, is the most conspicuous and makes an excellent landmark.

Bank.—Eight soundings show a bank with depths of from 39 to 107 fathoms hard or rocky bottom, about 15 miles southwestward of Point Antonio and 6 miles outside the 100-fathom curve. The extent of the bank is not known, as no further examination has been made.

Position.—The least depth found on the bank, 39 fathoms, is in latitude 29° 34′ N., longitude 115° 53′ W., 14¾ miles 220° from Point Antonio.

Bluff Point, 201 miles from Point Antonio, is a bold sand bluff 100 feet high, closely backed by hills. A large field of kelp, about 5 miles in length, lies 11 miles westward of the point and extends about 5 miles offshore; in this field depths of 6 to 9 fathoms have been found, bottom hard sand and rock.

Canoas Point is a sharp perpendicular sand bluff, 224 feet high, surrounded by hills from 700 to 1,200 feet high, which are backed by a mountain range more than 2,000 feet high; two peaks of this range, called San Pedro and San Pablo, in close proximity to each other, 17 miles northeastward from the point, are respectively 2,620 and 2,615 feet high; and San Miguel, the highest peak of the range, 13 miles northward of the twin peaks, is 3,598 feet high.

Anchorage partially protected from the prevailing wind will be found in good weather under the lee of the point in from 5 to 7 fathoms water, sand bottom, about ½ mile from the shore.

Between Canoas Point and Blanca Point, a distance of 32 miles. 127°; the coast recedes to the eastward 4½ miles and is composed of sand bluffs and rocky points alternating with low sand beaches. From seaward three distinct mountain ranges are visible; the first or coast range is from 500 to 1,000 feet high; the second, behind the first, is 2,000 feet high; the third, behind the second, rises to a height of more than 3,000 feet. About 14 miles northwestward of Blanca Point and ½ mile offshore is a solitary rock, 20 feet high, surrounded by kelp. Large quantities of driftwood were found on the beach in the vicinity of this rock.

Blanca Point is a steep sand cliff about 100 feet high; the coast range rises immediately behind it. A similar point $\frac{7}{8}$ miles to the northwestward projects seaward about $\frac{1}{2}$ mile and is surrounded by detached rocks.

Blanca Bay, eastward of the point, is a deep indentation of the coast and affords good anchorage in from 6 to 8 fathoms, sand bottom, with shelter from the prevailing wind. Just within the shore line at the head of the bay is the dry basin of a small lagoon, and about a mile southeastward of this one is a much larger dry basin in a plain that extends back several miles between the hills.

The coast from Blanca Point to Cone Point is a succession of bluff points and sandy beaches.

Cone Point, 10 miles 143° from Blanca Point, is a steep and rocky double-pointed headland with a reef of rocks projecting a quarter of a mile to the southward. Just north of the point is a conspicuous hill, 169 feet high, of reddish color, called Red Cone; when first seen from the northward it appears as an island.

Falsa Bay is formed by an indentation of the coast to the eastward of Cone Point; its shores are quite low and consist of sand and shingle beaches to within 1½ miles of Maria Point; thence to the

point the coast is steep and rocky. A wide arroyo with sand hills on either side opens on the bay $1\frac{3}{4}$ miles eastward of Cone Point and is a conspicuous feature.

The bay, though shoal, affords anchorage in from 4 to 6 fathoms, with fair protection from the prevailing winds. It is unimportant because of the better anchorages afforded by the near-by Blanca and Playa Maria Bays.

Maria Point is a low rocky point, 4 miles 133° from Cone Point, and is marked by a sand mound, 66 feet high, ½ mile to the northward. A round-shaped rocky point 1½ miles northwestward of Maria Point forms the southern limit of Falsa Bay.

Sebastian Viscaino Bay.—From Maria Point the coast sweeps around to San Eugenio Point in an almost unbroken curve, and with Cerros Island on the west forms the great bay of Sebastian Viscaino, which is about 60 miles in diameter and 48 miles wide in the opening between Maria Point and the north end of Cerros Island; within its limits are a number of smaller bays and anchorages. The eastern shores of the bay are generally low and sandy, with extensive marshes, high mountain ranges rising far in the interior. The south coast has the same general character until, at the southern limit of the bay, high bluffs begin and the mountains approach the coast; nearer San Eugenio Point the character of the coast again changes, rocky formations predominating and forming a steep, rocky point called False Point.

Near the shores of the bay fish are plentiful and of many varieties. The great jewfish attains here a weight of several hundred pounds and, notwithstanding its great size, is easily caught with hook and line. The flesh of this fish, though coarse, is well flavored and makes an excellent chowder. Sharks are numerous wherever the water is shoal.

Playa Maria Bay is a wide indentation of the coast between Maria Point and Black Point; its shores are low, sandy, and barren, but a few miles inland there is a little vegetation. Rising abruptly from the water on the northern shore of the bay is a conspicuous coneshaped hill, 236 feet high, called Station Peak.

Good anchorage will be found under Maria Point, in 6 or 7 fathoms, sand, with protection from the prevailing wind; a swell usually sets in, making the anchorage uncomfortable.

Tides.—High water at full and change is at 9h. 20m.; springs rise and fall approximately 7 to 9 feet.

Position.—The mound, 60 feet high, on Maria Point is in latitude 28° 55′ 49″ N., longitude 114° 32′ 18″ W.

Black Point, which is taken as the southern limit of Playa Maria Bay, lies 10½ miles 131° from Maria Point; it is a dark-colored rocky point and is marked by a hill, 609 feet high, rising close to it.;

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a second hill, 517 feet high, stands close to the shore about $\frac{3}{4}$ mile to the northward of the point. The shore line of the bay is broken by two other prominent rocky points, behind which are hills about 1,200 feet high, with other higher hills and mountains stretching far away toward the interior.

Two miles below Black Point is a steep, rocky, rounded point with a conspicuous sand hill, 688 feet high, rising from it; about 1½ miles farther is another bluff-shaped projection, and close to it a detached hill 386 feet high; off both of these points are detached rocks; with these exceptions the coast, as far as Rocky Point, consists chiefly of sand beaches.

Rocky Point, 5 miles 155° from Black Point, is a steep cliff 75 feet high, the abrupt termination of a ridge of high hills at right angles to the coast line; a conspicuous conical hill, 928 feet high, rises $1\frac{\pi}{8}$ miles eastward of the point. The high peaks of Cerros Island, some of them 60 miles distant, are clearly visible from this vicinity.

For 3½ miles southeastward of Rocky Point the coast is bold and rocky, with cliffs 50 feet high; thence to Elide Islet it consists chiefly of low sand beach.

Elide Islet lies $\frac{3}{4}$ mile northwestward of Rosalia Point and is a barren rock about $\frac{1}{4}$ mile long and 40 feet high, covered with a thin layer of guano; a sand spit, over which the sea breaks, connects the rock with the mainland, distant $\frac{1}{4}$ mile. The islet is a favorite resort of seal and sea fowl.

Vessels sometimes anchor off the southeast side of the islet, but the anchorage is not recommended, as a heavy swell usually heaves in there.

Rosalia Point, 6% miles 136° from Rocky Point, is a bluff 87 feet high, the abrupt ending of a mesa which extends back several miles from the coast; a second point, sharp and angular in contour and with bluff sides, lies 1½ miles eastward of the first and projects southward ¾ mile; both points appear to be clean, but within the second shoal water extends ½ mile from the shore.

Santa Rosalia Bay, eastward of Rosalia Point, affords a good and spacious anchorage in from 5 to 10 fathoms, sand, well sheltered from the coast wind. The best landing place is on the shingle beach in the northern part of the bay, off a conspicuous break in the mesa; eastward of this break is a canyon through which a trail leads to a ranch 12 miles distant. The eastern shore of the bay consists of a low sand beach backed by the bold rocky cliffs of a broad mesa 90 to 150 feet high. Clams may be obtained by digging on the beach. No fresh water has been found.

Position.—The observation spot, situated in the break of the mesa, near the shore about 1½ miles northeastward of the inner point, is in latitude 28° 40′ 15″.5 N., longitude 114° 14′ 14″.5 W.

San Rosarito Point, 8½ miles 134° from Rosalia Point, marks the southern limit of Rosalia Bay and is a low projecting point with numerous outlying rocks; a dangerous reef and shoal water extend ½ mile from the shore and are bordered by a field of kelp.

South of San Rosarito Point the coast recedes about 5 miles to the eastward, forming between the point and Lagoon Head, 19 miles distant, a large open bay with bluff shores from 50 to 100 feet high, increasing to 200 feet as Lagoon Head is approached; a low flat country borders on the shore, but high hills rise a few miles inland, and mountain ranges are visible in the interior, the most conspicuous peak being High Leaning Peak, the jagged top of which appears to overhang.

Lagoon Head is a bold dark-colored headland of volcanic origin, 502 feet high, and can be seen a distance of from 30 to 40 miles; when first seen from seaward it appears as an island.

Lagoon Head Anchorage is in the small bay eastward of the head. The northern part of the bay is very shoal, but vessels may anchor in 5 to 6 fathoms, sand, and find fair shelter from the prevailing wind. A good landing place will be found on a sand beach at the foot of the bluffs, about a mile within the southernmost point of the head.

Manuela Lagoon, the northernmost of the three large lagoons that open into Sebastian Viscaino Bay, is about 8 miles long, north and south, and about 2 miles wide; a narrow strip of low sand beach, interspersed with small hillocks and partially covered with stunted bushes, separates it from the waters of the bay. The entrance, about 4 miles southeastward from Lagoon Head, is obstructed by a bar which makes off about a mile and has 5 feet of water over it at low tide; the sea usually breaks on the bar, even in fine weather, except near high water.

Black Warrior Lagoon, the entrance to which is $6\frac{1}{2}$ miles southwestward from that of Manuela Lagoon, takes its name from that of a bark lost on the bar in 1859, while attempting to enter, having mistaken the entrance for that of Scammon Lagoon. It is about 10 miles long, north and south, and 3 miles wide; shoal water extends from $1\frac{1}{2}$ to 2 miles off the entrance. Vessels drawing 13 feet have crossed the bar.

Shoal.—Breakers have been reported, on what was presumed to be a shoal, 9½ miles 254° from the south entrance bluff of Black Warrior Lagoon.

Scammon Lagoon, or Ojo de Liebre, the southernmost and much the largest and most important of the lagoons that open into Sebastian Viscaino Bay, is studded with low islets and has numerous sand bars, many of which uncover at low tide; it has not been surveyed, and opinions differ greatly as to its extent. Capt. Scammon states that its eastern limit is about 35 miles from the bar, and that it varies in width from 4 to 12 miles; a navigable branch, known as Fort Lagoon, extends 8 miles to the southward of the main lagoon.

The entrance, 153 miles southwestward of Black Warrior Lagoon, is marked on either side by white sand bluffs, 30 to 40 feet high, and extensive shoals make off nearly 7 miles to the northward of it and nearly 4 miles from the shore.

The bar, which is about ½ mile wide and ¼ mile long in the direction of the channel, appears to have a good low-water depth of 2 fathoms, and a closer development might show more water, as it is said that 18 feet have been carried over it; within the bar the water deepens rapidly to 4, 5, and 6 fathoms. No definite directions can be given for crossing the bar, which is constantly changing; its passage should not be attempted by a stranger without sending a boat ahead to sound, or, if necessary, buoying the channel.

Within the lagoon a good channel is found along the south shore, reaching nearly to the head. North of this channel are numerous sand bars and low islets, the latter being the breeding places of seals and sea fowl.

The surrounding country for miles from the shores of the lagoon is a sandy desert, the only vegetation consisting of a few clusters of dwarfed shrubbery and the ever-present cactus. The nearest fresh water is said to be 7 miles distant, and all supplies, except fish, turtle, and sea fowl, must be brought from the interior or imported by sea. South and southwestward from the lagoon may be seen the high bowlderlike peaks of the Santa Clara Mountains.

The following is from a report by Capt. Scammon: "The passage into it is lined on the south side by a continuous line of breakers, forming a curve which extends 4 miles from the heads of the harbor and reaches the bar, which has 3 fathoms over it at ordinary tides; detached breakers on the north side plainly indicate that side of the channel, which is of sufficient width to afford a good beating passage for a vessel of 300 tons, drawing 12 feet."

Salt fields.—Near the head of the lagoon are the salt fields of Ojo de Liebre, which are said to be capable of furnishing an almost unlimited supply of salt. Vessels of 400 tons may lie within 5 miles of where it may be put into lighters of from 25 to 50 tons capacity.

Coast.—From the mouth of Scammon Lagoon the low sandy shore, backed by low sand hills, continues about 8 miles, when the bluffs begin, and at Point Malarrimo, 6 miles beyond, the high hills ap-

proach the coast, the point being marked by a hill 632 feet high. As far as Point Malarrimo, shoal water extends from ½ mile to 1 mile from the shore; thence to False Point the coast is clear, with no outlying dangers excepting a rock, ½ mile from shore, in a small bight 11 miles eastward of False Point.

False Point, the northernmost part of the San Eugenio promontory, nearly 2 miles northeasterly from San Eugenio Point, is steep and rocky. Half a mile northward of the point lies a dangerous oval-shaped reef, 4 miles long by 4 mile wide, surrounded by kelp; near the middle of the reef is a rock awash, over which the sea beats heavily. From 7 to 8 fathoms, rocky bottom, were found between the reef and the point, and also between the reef and the western Chester Islet.

Chester Islets are two rocks, 18 feet high, covered with guanc. The western islet lies ½ mile northeastward from False Point, and has a small outlying rock close-to, on the north side; the eastern islet lies 1.300 yards about east-southeastward from the western one, 1½ miles from the point, and 1,000 yards offshore. The passage between the two islets and that between the islets and the shore are filled with kelp, and, though no hidden dangers were found, are not recommended.

San Eugenio Point, the northwestern extremity of the tongue of land that forms the southern shore of Sebastian Viscaino Bay, lies nearly 2 miles west-southwestward from False Point and is a dark rocky projection surrounded by a reef which extends about 1 mile from the shore. There was formerly a whaling station in a little cove about 1 mile to the eastward of the point.

Natividad Island, lying northwestward of San Eugenio Point and separated from it by Dewey Channel, is 3\frac{3}{4} miles long from northwest to southeast, and from \frac{1}{2} mile to 1\frac{1}{2} miles wide, being widest at its southeastern end; it is barren and hilly, rising near the middle to a height of 491 feet, with mostly steep, rocky shores bordered by detached rocks and kelp; several reefs make off from the northeast side of the island; on the southeastern end is a sand beach about \frac{1}{2} mile long.

Maria Rock, 15 feet high, lies 1 mile off the northwest point of the island, and is connected with it by a reef.

Sail Rock, a pointed rock 56 feet high, lies about 400 yards west of the southern point of the island; extending from the rock to the southward and eastward is a reef on which, in fine weather, the sea breaks only at long intervals.

Flat Rock, 24 feet high, lies about 1 mile eastward of the southern point of the island, and is connected with it by a reef on which the sea breaks continually.

A patch of kelp, triangular in shape, about 600 feet long and 150 feet broad at its wider part, has been reported to have formed near the edge of the 9-fathom curve, 2 miles southward of Sail Rock.

Dewey Channel is nearly 4 miles wide between Natividad Island and the reefs off San Eugenio Point, and with proper care may be safely used. On the Natividad side of the channel there is much foul ground, and the soundings are very irregular; on the San Eugenio side there is a clear passage a mile wide, through which, at a distance of about 1½ miles from the shore, may be carried from 17 to 20 fathoms, the kelp on either side plainly marking the channel. The tides are said to run through this channel with some strength at the periods of full and change.

Vessels skirting the coast in making the passage north, to avoid the strong northwest wind and leeward current, gain a considerable advantage by passing through Dewey Channel and along the east side of Cerros Island; after passing the island the same north course leads to Canoas Point, whence the trend of the coast may be again followed.

Lowry Rock, 1½ miles eastward of Flat Rock, is a circular shool about half a mile in diameter, with rocky bottom, having 1½ fathoms over it and from 6 to 10 fathoms around it; the sea breaks on it in fine weather only at long intervals. About 1½ miles southward of the rock is a 5½-fathom spot.

Kellettt Channel, between Natividad and Cerros Islands, is 8 miles wide and carries, a little south of mid-channel, a least depth of 21 fathoms into Sebastian Viscaino Bay; passing through Dewey and Kellett Channels a least depth of 17 fathoms may be carried on a straight course. The channel is believed to be free from danger, but on the northern side the soundings are irregular, and patches cf 4\frac{3}{4} to 10 fathoms, with fields of kelp, are found to a distance of 2 miles from Cerros Island.

Cerros Island, also called Cedrcs Island, is nearly 21 miles long, north and south, and in width varies from 3 miles near the northern end to 9 miles near the southern end. It is of volcanic origin, a mass of high, abrupt peaks, the highest being 3,950 feet high, and in clear weather can be seen from a distance of 60 miles, having when first sighted a very irregular and broken outline. The southern part of the island is generally barren, but the northern part is comparatively fertile, the crests and western slopes of the mountains being covered with a growth of cedars and pines, some of which attain a height of 60 to 70 feet. A species of dwarf oak is also found, and many varieties of shrubs and flowers are met with in the ravines.

Wild goats and rabbits are numerous on the island, especially in the northern part, and there are some deer; its shores are the resort of scals. There are gold mines on the island. The steamer of the Lower California Development Co. calls here when necessary.

Morro Redondo Point, the southeastern extremity of the island, distant 12½ miles from San Eugenio Point, is a rocky cliff 30 feet high; there are outlying rocks south of the point to a distance of § mile, and others west of it. El Morro Redondo lies just within the point, and about half a mile to the northward of the point is a low point with a shingle beach and outlying rocks.

Anchorage may be found to the northward of the low point, the coast receding slightly, in 7 to 10 fathoms, sand, not over $\frac{1}{2}$ mile from the beach. Care must be taken not to let go the anchor too far offshore, as the water deepens suddenly.

Watering place.—About 3½ miles north of the anchorage and 4½ miles from Morro Redondo Point is a good watering place, easily recognized by a patch of tall, rank grass behind a sand beach about 250 feet in length and the only one in the vicinity. The course of the stream ends in an arroyo about a mile to the southward of the easternmost point of the island and ½ mile from the beach, where it is lost in the sand. Abreast of the watering place the water is deep close to the shore, there being 20 to 25 fathoms within 1,200 yards of the beach.

Other fresh-water springs have been found in some of the ravines to the northward, where landings can be effected.

The eastern side of the island, north of the watering place, is a succession of rocky bluffs and ravines with short stretches of gravel beach; from the shore line the land rises abruptly in short ridges and precipitous cliffs to mountain peaks upward of 3,000 feet in height. The sea is generally smooth on this, the lee side of the island, and deep water extends close up to the shore, which is free from kelp.

A pier and settlement, conspicuous from the sea, lies about \(\frac{3}{4} \) mile southward from the northeast point.

Anchorage.—On the northeast side of the island, about 3 miles from the north end, a low sandy point makes out, southward of which there is good anchorage during the prevailing wind. In a ravine near the anchorage is a small stream of fresh water.

The northern point of the island is formed by broken bluffs, with many large outlying rocks. A sharp peak, 1.714 feet high with a comb or crest of cedar trees, rises just behind the point.

The western side of the island for about 8 or 9 miles from the northern point has the same general character as the eastern side, but the outlying rocks are more numerous and extend farther offshore; thence the coast curves around to the southwestward and is an unbroken line of steep cliffs as far as the point, 2½ miles north of Cape San Augustin. A stony beach fronts these cliffs for the entire

distance except about 2½ miles in the middle, where a rocky ledge with outlying rocks extends into the sea. There is generally a heavy surf on this side of the island and much kelp along the shore, especially on the southwestern side.

Red Rock.—From the point 2½ miles north of Cape San Augustin a reef of rocks makes off about 2 miles northwestward; half a mile within the outer extremity of this reef is a conspicuous red rock 44 feet high.

Wreck.—The wreck of a steamer lies about 2 miles eastward of Red Rock.

Cape San Augustin, the southwestern extremity of the island, is a bold basaltic headland, the termination of a range of high hills separated from the main range of mountains. San Augustin Peak, within the cape, rises abruptly from the shore to a height of 790 feet. A reef that breaks in heavy seas lies 1 mile southwestward of the cape in a field of kelp that extends $2\frac{1}{2}$ miles from the cape in the same direction.

South Bay, a wide and deep indentation between the San Augustin headland and the south point of the island, affords a good and spacious anchorage in 6 to 15 fathoms, well sheltered from the prevailing wind, but open to the southerly gales that sometimes occur during the early part of winter. The shore consists of a succession of rocky bluffs and ravines, backed by hills, and a broken country that rises less steeply than on the east side of the island; on the northern and eastern sides of the bay sand beaches front the bluffs; in the northwestern part there are many patches and fields of kelp, and outlying rocks, extending more than half a mile from the shore. There is also much kelp near the southeastern shore of the bay, and a group of rocks lies half a mile within the southeastern point and the same distance from the shore. A wide ravine or break in the hills connects the northwestern part of the bay with the west shore of the island.

The best landing place is in a cove on the western side of the bay about $\frac{1}{8}$ mile northward of a remarkable conspicuous black rock, 158 feet high, rising from the shore $\frac{3}{8}$ mile northward of the southeastern extremity of the San Augustin headland. The landing place is in latitude 28° 05′ 18″ N., longitude 115° 20′ 17″ W.

Tides.—The tide station was near the landing place in South Bay. The average lunitidal interval for high water is 8h. 40m.; for low water, 14h. 45m.; the mean rise and fall of the tide is 4.29 feet.

Southeast Bay.—From the eastern limit of South Bay to Morro Redondo Point, about 4 miles, the shore is bold and rocky, with many outlying rocks; the soundings offshore are very irregular, from 10 to 15 fathoms being found within a mile of the coast and patches of from $4\frac{3}{4}$ to 10 fathoms, rocky bottom, as far as 3 miles offshore

to the southward. These rocky shoal patches are in general marked by patches of kelp.

An indentation of the south coast between Morro Redondo Point and the south point of the island, called Southeast Bay, affords an anchorage in 7 to 8 fathoms, with shelter from the prevailing wind.

Fogs.—Low fog banks are of occasional occurrence in the morning, the peaks of the island showing plainly above them.

San Benito Islands, a group of three barren rocky islands surrounded by outlying rocks and kelp, lie at their nearest point 15 miles westward of the northern part of Cerros Island, and cover an area of nearly 4 miles in longitude by 1½ miles in latitude.

West Benito, the largest island, has bold and rocky shores, and consists of an elevated plateau with a mound near its center 661 feet above the sea. There is anchorage on the south side of the island in 10 fathoms, sand, a little to the westward of the south-castern point; a better anchorage will be found on the east side, in the bay formed by the adjoining shores of West and Middle Benito, where, in about 10 fathoms, sand, there is excellent shelter from the prevailing wind and also from the swell. The best landing place is behind some rocks in an indentation of the east shore of West Benito, ‡ mile northward of the southeast point.

Shoal.—Two soundings of 13 fathoms were obtained 10 miles 275° from the southwestern end of West Benito Island. Much kelp was noted in the vicinity. Breakers have been reported 9 miles 292° and 2 miles 186° from the same point.

Middle Benito is a flat low island, its highest part only 82 feet above the sea, separated from West Benito by a passage about 200 yards wide and 2 fathoms deep. The south shore of the island is bordered by foul ground; a conspicuous rock lies \(\frac{1}{2}\) mile south of the south point of the island, and \(\frac{1}{2}\) mile westward of this rock, directly opposite the passage, is a smaller rock; no dangers were found south of the range of these two rocks, which are convenient guides in choosing an anchorage.

East Benito, the second largest island, is marked by four prominent hills, the highest of which is 421 feet high; there is foul ground on the northwestern side to a distance of \(\frac{1}{2}\) mile, and two conspicuous outlying rocks lie respectively \(\frac{1}{2}\) mile west of its southern end and north of its northern end.

Peck Channel, between Middle and East Benito Islands, is nearly $\frac{1}{2}$ mile wide, with depth from 12 to 25 fathoms, and they may be safely used by following a mid-channel course. There are no known dangers outside of $\frac{1}{2}$ mile from the shore except a 4-fathom spot that lies less than $\frac{1}{2}$ mile 235° from the prominent westernmost point of East Benito.

Pinnacle Rocks, lying 1 mile westward of the southwest point of West Benito, are two small rocks with 6 feet of water over them, 80 feet apart, northeastward and southwestward, the southern one about 30 feet and the northern one 10 feet in length on top and from 2 to 4 feet wide; the sea breaks on them in all weathers. At 100 feet east of the rocks bottom was found at 12 fathoms, but at no other place at the same distance was bottom found at 20 fathoms.

Tides.—The average lunitidal interval for high water at the West Landing cove of West Benito is §h. 58m.; for low water, 15h. 14m.; the mean rise and fall of the tide is 3.71 feet.

Ranger Bank lies at its nearest point 6 miles north of East Benito Island and extends thence, within the 100-fathom curve, 11½ miles to the northward, with a width of from 2 to 4 miles; the least depth found on it was 67 fathoms, rocky bettom. Between the bank and the islands a depth of 304 fathoms was found.

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CHAPTER III.

WEST COAST OF LOWER CALIFORNIA FROM SAN EUGENIO POINT TO CAPE SAN LUCAS, WITH SAN LUCAS BAY.

Coast.—From San Eugenio Point the coast trends southeastward 9 miles to Breaker Point, and consists of rocky bluffs with projecting points and outlying rocks surrounded by kelp; sharp bare hills rise close to the coast; the most conspicuous of these, over 600 feet high, lies 11 miles northwestward of Breaker Point.

Breaker Point is a steep rocky headland, with numerous detached rocks lying to the southward of it, over which the sea breaks heavily. Eastward of Breaker Point the land is lower, but rugged and barren, and recedes 1½ miles, forming a bay in which there in anchorage with protection from the prevailing wind.

Kelp Point, the northwestern entrance point of Port San Bartolomé, is about 30 feet high, composed of conglomerate on a bed of sandstone, with many outlying rocks surrounded by kelp. From the point the land rises rapidly to Mount Bartolomé, 871 feet high. For 2 miles northwestward of the point foul ground with numerous rocky shoal patches extends nearly ½ mile from the coast, which is lined with kelp.

Cape Tortolo, the southeastern entrance point of the port, is a rocky point, about 20 feet high, that marks the abrupt termination of a narrow promontory 417 feet high; from the cape a reef projects northwestward nearly a mile, its outer end being marked by a rock 2 feet above high water. Between this rock and the cape there are three large conspicuous rocks; Sulphur Rock, the outermost, is 30 feet high; Coffin Rock, the middle one, 40 feet high; the one nearest the cape, 60 feet high. There are numerous smaller rocks awash and above water, the whole forming a natural breakwater against which the sea breaks heavily.

Port San Bartolomé is the best harbor on the coast between San Diego and Magdalena Bay, and was formerly much frequented by whalers for the purpose of refitting their ships and coopering their oil. It is nearly circular in shape, with a diameter of about 2½ miles. The entrance, between Kelp Point and Cape Tortolo, is a mile wide between the rocks that make off from either side, 10 fathoms deep; the water shoals gradually within to 7 and 6 fathoms. Several shoals have been reported in the entrance at the

following distances and bearings from Entrance Rock: 4½ fathoms 260 yards 0° 45′; 5 fathoms 500 yards 335°; 4½ fathoms 1,460 yards 297°; 3½ fathoms 800 yards 278°.

The northern and eastern sides of the bay are low shingle and gravel beaches, with generally sandy and lowland behind them, which gradually rises to a higher broken country with but few traces of vegetation; the western shore consists of high bluffs. The bay is a resort for sea fowl and abounds in fish and turtle, both of which can best be taken by seining on the southern shore; no indications of fresh water are found.

Anchorage may be taken anywhere in the bay after passing the reef that makes off from Cape Tortolo; the soundings are regular and the bottom sand. The northern part of the bay is somewhat exposed to the long regular swell from the ocean. The best anchorage is in Turtle Bay under Cape Tortolo reef, in from 3½ to 6 fathoms, where perfectly smooth water will be found with pretection from all winds.

Tides.—The average lunitidal interval for high water is 8h. 50m.; for low water, 14h. 38m.; the mean rise and fall of the tide is 4.86 feet.

Position.—The Cape Tortolo observation spot is in latitude 27° 38′ 55″ N., longitude 114° 51′ 53″ W.

Thurloe Head, a bold rocky point, lies about 2½ miles southeastward from Cape Tortolo, the intervening coast being a long irregular cliff from 25 to 100 feet high, rocky and steep, with high hills just behind it. A reef projects from the head about 400 yards to the southward, and another reef the same distance to the westward.

Anchorage may be found to the eastward of the head in Thurloo Bay, formed by a recession of the coast, in 6 to 7 fathoms water, with protection from the prevailing coast wind. The land at the head of the bay is low, with a shingle beach backed by sand hills.

Morro Hermoso, a hill 900 feet high, rises abruptly from a bare rocky cliff at the turn of the coast, 8 miles southeastward from Thurloe Head. From the southern part of Thurloe Bay to Merro Hermeso Point the coast consists of steep bluffs, from 50 to 100 feet high, immediately behind which is a range of hills from 1,400 to 2,000 feet high. Hermoso Peak, 2 miles eastward of the point, is 2,018 feet high.

A sounding was obtained of 38 fathoms fine gray sand 6 miles 240° from Morro Hermoso and near the 100-fathom curve.

San Cristobal Bay.—Between the Morro Hermoso and San Pablo Points, 22 miles, the coast recedes 5\frac{3}{4} miles, forming the bay of San Cristobal, the shores of which consist chiefly of bluffs and sand cliffs from 50 to 100 feet high, the coast range rising a short distance inland to a height of several hundred feet; a strip of sand beach 4

miles long breaks the line of sand cliffs where the indentation of the coast line is deepest. There is a deep arroyo 6 miles north of San Pablo Point. Near the shcre in the northern part of the bay are the Gull Rocks, and 4½ miles southeastward from them is Bird Rock.

San Patlo Point is a dark slate-colored bluff, with a prominent hill 760 feet high rising directly from it. A reef projects southward from the point ½ mile. Outside this the water deepens rapidly, 50 fathoms being found at 1 mile and 100 fathoms at 1½ miles from the land.

Extensive table-lands from 1,000 to 2,000 feet high rise a few miles in the interior, and behind these is a remarkable range of peaks from 2,000 to 3,000 feet high, of variegated colors.

San Pablo Bay, formed by an indentation of the coast between San Pablo and San Roque Points, is apparently free from all dangers, and affords good anchorage in from 10 to 15 fathoms at about \$\frac{3}{4}\$ mile from the shore. At the head of the bay is a sand beach, about \$\frac{3}{4}\$ mile long, with steep bluffs on either side of it.

San Roque Point, 3½ miles southeastward from San Pablo Point, is a light-colored bluff 30 to 50 feet high, backed by San Roque Peak, 518 feet high. The water is deep close up to the point, 20 fathoms being found at a little more than ½ mile from it. For 1½ miles southeastward of the point the coast is bordered by foul ground to a distance of ¼ mile.

San Roque Bay, eastward of the point, affords a fair anchorage in 10 to 12 fathoms, well protected from the prevailing wind. The shores of the bay consist of shingle and rocky beaches backed by sand bluffs. Behind the coast is a hilly country, with table-lands a few miles in the interior.

San Roque Island, lying 3 miles scutheastward from the point and 2 miles from the head of the bay, is a rugged rock 4 mile long, east and west, 4 mile wide, and 50 feet high. A reef, over which the sea breaks, projects 4 mile from the eastern end of the island, and 4 mile farther eastward is a patch of rocks, with 84 fathoms between it and the reef. North of the patch of rocks nearly 4 mile is a 34-fathom spot.

Heavy breakers extend off from the mainland north of the island, marking the shoal water that borders the shore. The passage between the island and the mainland, while appearing to carry from 7 to 8 fathoms through its middle, is not recommended, as the development has not been close.

Asuncion Point, 8 miles from San Roque Point and forming the castern limit of San Roque Bay, is a low, narrow bluff point, with a cone-shaped mound about 75 feet high at the outer end, and moderately high hills a short distance inland. The point is bordered by

reefs and several large detached rocks, against which the sea breaks heavily, and the water is shoal to a distance of 1 mile on either side.

Asuncion Island, nearly $\frac{3}{4}$ mile southward from the point, is about $\frac{7}{6}$ mile long, north and south, $\frac{1}{4}$ mile wide, and at its southern end 165 feet high; it is of sandstone formation and entirely barren. The island is surrounded by detached rocks and kelp; from its northern end a reef of rocks, many of them above water and two of large size, projects 600 yards to the northward and $\frac{1}{2}$ mile to the westward; from its southern end a reef projects $\frac{1}{4}$ mile to the southward; the sea breaks over these reefs continually. Shoal water extends in a narrow ridge all the way from the island to the point, and about midway is a group of rocks awash at low water.

Position.—The hill at the southern end of Asuncion Island is in latitude 27° 06′ 10″ N., longitude 114° 17′ 25.″3 W.

Asuncion Bay, eastward of the point, extends 1½ miles northward of the point and more than 3 miles northward of the south end of Asuncion Island, affording good anchorage in moderate weather under the lee of the point in 5 to 10 fathoms, sand, within ½ mile of the shore; offshore the soundings deepen rapidly to 30 fathoms.

From Asuncion Point to San Hipolito Point the coast recedes several miles, and is low and sandy, with an occasional bluff. Hills and table-lands of moderate elevation rise at a short distance inland.

Tides.—High water in Asuncion and San Roque Bays, at full and change, is at 9h. 2m.; the mean rise and fall of the tide is 41 feet.

San Hipolito Point, 17½ miles southeastward from Asuncion Point, is a low black rocky point, backed by barren sand hills 50 to 100 feet high. A shelving reef, over which the sea breaks, projects from it nearly ½ mile southward. The remarkable Table Mountain, 1,327 feet high, rises 6 miles northward of the point.

San Hipolito Bay, the deep bight eastward of the point, affords good anchorage under the lee of the point in 5 to 6 fathoms, sand, ½ mile from the shore.

Coast.—From San Hipolito Point to Abreojos Point, 28 miles, the coast recedes 5 miles and is low and sandy, the land behind it rising gradually to hills and table-lands from 600 to 1,000 feet high, with high and broken mountains in the distance. The soundings are regular, with bold water to within 11 miles of Abreojos Point, when they become irregular, with much shoaler water.

At the turn of the coast, 10 miles northwestward from the point, a reef projects ½ mile to the southward; 1 mile nearer the point a much larger reef, over which the sea breaks heavily, projects from the coast more than a mile to the southward, bounding the west side of the shoal that extends several miles along the coast and 1½ miles from it at the mouth of Pond Lagoon that lies parallel with the coast and ends near Abreojos Point.

Abreojos Point is low and sandy, and is composed of a bed of conglomerate, which rises about 5 feet above high-water mark, covered by a layer of sand 10 to 15 feet deep, in which grow some stunted bushes. A reef projects a short distance south from the point, and there are numerous detached rocks on the eastern side, close to the shore.

A barren, detached hill 312 feet high, in front of a conspicuous range of table-land 600 feet high, lies 3 miles 7° from the point and is a good landmark for it when off the coast. At the foot of the hill, on its southeast side, is a pond of brackish water not fit for drinking purposes, but from the large number of animals seen in the vicinity it seems probable that there is fresh water at no great distance. The shores near Abreojos Point are strewn with the bones of whales, with which creatures these waters formerly abounded.

Whale Rock, 4 miles (263°) from Abreojos Point, is 10 feet above high water, of small extent, and surrounded by reefs, the whole covering an area nearly $\frac{3}{4}$ mile long and half a mile wide, over which the sea breaks heavily. A smaller rock 3 feet above water rises from the shoal about $\frac{1}{4}$ mile southeastward from Whale Rock. The passage, $1\frac{1}{2}$ miles wide, between the rock and the mainland carries a depth of $4\frac{1}{2}$ fathoms.

Reports of the nonexistence of this rock but of the existence of a rocky shoal about ½ mile in diameter, marked by breakers, have been received.

Reef.—A dangerous reef lies 1 mile southwestward from Whale Rock, separated therefrom by a clear passage \(\frac{3}{4} \) mile wide, with from 6 to 8 fathoms water. The reef is \(\frac{5}{2} \) mile long, north and south, and \(\frac{1}{2} \) mile wide, with many rocks awash at low water over which the sea breaks heavily.

Wright Shoals, consisting of several shoals with from 2 to 3 fathoms of water over them and clear water between them, lie from 1 mile to 13 miles off Abreojos Point, between the bearings 180° and 146°. The passage between the shoals and the point is § mile wide, with depths from 6 to 7 fathoms.

Kneeper Shoal, with $2\frac{1}{4}$ fathoms of water over it, lies $2\frac{1}{2}$ miles (75°) from Abreojos Point and 1 mile offshore.

Abreojos Anchorage, eastward of the point, affords good anchorage, protected from the prevailing winds, in about 6 fathoms, sand, 1 mile from a sandy beach, where in moderate weather boats may readily land.

In making for the anchorage the point 13 miles eastward of Abreojos Point may be steered for on a bearing 45°, passing about midway between Wright Shoals and the reef off Abreojos Point; it is safer, however, to pass to the southward of the shoals, giving them a good berth and approaching the anchorage from the southeastward.

Tides.—High water at Abreojos Anchorage, at full and change, is at 9h. 3m.; the mean rise and fall of the tide is 4.6 feet.

Position.—The observation spot, near the sand beach northward of Abreojos Point is in latitude 26° 42′ 50″.4 N., longitude 113° 34′ 13″.3 W.

Currents.—The U. S. S. Thetis found that between Abreojos Point and the entrance to Magdalena Bay the currents near the shore set invariably to the southward; offshore they were frequently found setting to the northward, the observations being made from the ship at anchor or while running sounding lines, when the ship's position was accurately known; on some lines currents were experienced running almost in opposite directions, the change being sometimes marked by a sudden change in depth; the lines of greatest length were 46 miles long and in direction normal to the coast.

Running along the coast with a spring flood setting into the mouths of lagoons, a ship will be swept toward the beach. This is often apparent when running down to make Cape San Lazaro, a ship finding herself fetching in to the coast north of the cape and the highland. Bound to the southward or to Magdalena Bay a course should therefore be laid well clear of this cape.

Ballenas Bay lies in a deep bight of the coast, open to the south, between Abreojos Point and the western end of the low sand island at the entrance of San Ignacio Lagoon, and is about 17 miles wide and 6 miles deep within these limits. The soundings in the bay are quite regular, with moderate depths close to the shore, except off the entrance of the lagoons, where there are extensive shoals. With strong winds a heavy swell rolls into the bay causing a high surf on the beach.

The shores of the bay are extremely low and sandy, except on the western side, where two rocky points are connected by a low bluff, behind which the land gradually rises to the hill 312 feet high, before described. At the head of the bay, 8½ miles from Abreojos Point, is the entrance to a lagoon which extends several miles in a northerly direction; a shoal over which the sea breaks extends ‡ mile off its mouth and only vessels of small size are able to enter the lagoon. Two miles from the coast and 6 miles from the entrance of San Ignacio Lagoon is a conspicuous conical sandhill of yellowish color.

The face of the country inland from Ballenas Bay and the lagoons is nearly level and extremely barren. A few stunted mesquite trees, patches of rush grass, and a large species of cactus are occasionally met with. In clear weather are plainly visible the high volcanic peaks of Las Tres Virgines, 6,547 feet high, which rise near the Gulf coast of the peninsula, 55 miles northeastward from the entrance of San Ignacio Lagoon.

San Ignacio Lagoon, which opens on the eastern part of Ballenas Bay, is a large sheet of water extending 16 miles to the northward of Bronaugh Point, the western entrance point, with a width of from 2 to 4 miles. Extensive sheals, which partly uncover at low water, make off to the southward 4 miles from Bronaugh Point and 13 miles from Holcombe Point, the western extremity of the sand island which fronts the entrance.

On its western side the lagoon is bordered by a low barren sandy plain, and on its eastern side by a sandy plain about 15 feet high, covered with sagebrush. The Whale Islands, in the upper part of the lagoon, are two low islands almost connected at their adjoining ends and extending about 3 miles parallel with the shores, with a width of less than ½ mile. The northern island has on its highest part a growth of green bushes, but the southern one is quite barren and is a resort for countless sea fowl. On the western shore, opposite these islands, is a flat hill, 198 feet high, conspicuous because of the low surrounding country.

The sand island fronting the entrance to the lagoon is about 8 miles long and lies in a curve of the shore, from which it is separated by a shoal passage about a mile wide and ½ fathom deep, which communicates with the sea at the eastern end of the island, and has shoals extending 1½ miles off its mouth. The passage, with ‡ fathom to 1 fathom of water, continues also southeastward 3½ miles behind another narrow sand island, at the eastern end of which it again communicates with the sea.

San Ignacio Village.—Not far from the head of the lagoon, at the foot of gradually rising mesas, is the village and former mission of San Ignacio, numbering about 20 families. Near the village there are said to be extensive cultivated tracts of land, in which are raised grain, all sorts of vegetables, sugar cane, dates, figs, olives, grapes, pomegrapates, and many other fruits. A never-failing supply of running water relieves San Ignacio from all fear of drought.

Anchorage in good weather will be found off the entrance of San Ignacio Lagoon in from 5 to 6 fathoms, sand, Bronaugh Point bearing 57°. Lying in this direction and leading up to Bronaugh Point is a passage through the shoals, with depths from 2½ to 1½ fathoms, which appears to be practicable for boats.

The channel through the shoals and into the lagoon is shown to be good and straight, with a least low-water depth of 3½ fathoms for a least width of ¾ mile. The bar, 1½ miles southwestward from Holcombe Point, is narrow and has over it a depth of 3½ fathoms for a channel ¾ mile wide ard 3½ fathoms for a less width, the water deepening within the bar to 4 and 5 fathoms, and the channel widening to nearly a mile, but again contracting to ¾ mile abreast of Holcombe Point, above which the water is deeper and the channel

broader until it enters the lagoon. Two miles above Bronaugh Point, where the lagoon expands, the channel also expands into a deepwater area about a mile square, with depths from 5 to 8 fathoms, affording excellent anchorage ground in a perfectly protected harbor. From here three channels branch off toward the head of the lagoon, of which the easternmost is the principal one and carries 3½ fathoms in a narrow and somewhat tortuous course for a distance of 7 miles; thence to the head of the lagoon the soundings vary between 1½ to 2½ fathoms.

The channel through the shoals is clearly marked by the lines of breakers on either side, which are the best guides for entering. A straight course 35° leads from the bar in mid-channel nearly up with Bronaugh Point, when the course must be changed to the northward to avoid the shoal water on the east side. Nearly opposite Holcombe Point, at the edge of the channel, with deep water close-to, is a reef that covers and uncovers with the tide. After passing Holcombe Point and the reef there are the north point of the sand island, Bronaugh Point, and the point closely bordering on the channel, $2\frac{1}{2}$ miles northeastward of Bronaugh Point, for use as landmarks in judging of the vessel's position.

Careful allowance must be made for the tides, which at the periods of full and change are strong and usually cause a heavy swell on the bar. The strength and regularity of the land and sea breezes in this vicinity greatly facilitate the use of this lagoon by sailing vessels.

Caution.—It is evident that an open sea bar is liable to frequent and sudden changes, and for this reason no definite directions can be given for crossing such a bar. No vessel should attempt to enter San Ignacio Lagoon without first sending a boat to examine or, if necessary, buoy the channel.

Tides.—The lunitidal interval for high water is 9h. 3m.; for low water, 15h. 47m.; the mean rise and fall of the tide is 5 feet.

Position.—Holcombe Point (extremity) is in latitude 26° 42′ 25″ N., longitude 113° 16′ 05″ W.

Weather.—It appears that strong winds blowing out of San Ignacio Lagoon may be expected from the middle of September to March and that fogs are very common during the winter months.

Hutchins Bank, a coral bank with 18 fathoms over it, lies 149° from Abrejos Point and 20¾ miles from the coast. Within the 25-fathom curve the bank is about 2 miles long east and west and a mile wide. The shoalest water, an 18-fathom spot, is on the southern side of the bank, in latitude 26° 21′ 30″ N., longitude 113° 20′ 30″ W.

Moore Bank, with 54 fathoms over it and 70 to 100 around it, bottom shell, lava, and rocks, is of small extent and is located in latitude 26° 05′ 15″ N., longitude 113° 25′ 20″ W. The 50-fathom curve lies less than 5 miles within this bank.

Coast.—From the entrance to San Ignacio Lagoon to Santo Domingo Point, 40 miles, the coast trends southeastward and for the entire distance is low and sandy, with several narrow lagoons lying parallel with the shore and separated from the sea by strips of sand beach about ½ mile wide, through which are several shallow passages, practicable only for boats and in smooth weather.

A series of irregular table-lands from 800 to 1,000 feet high rises abruptly from the lowland at a distance of 10 miles from the coast in the vicinity of San Ignacio Lagoon and, gradually converging, meets the coast at Santo Domingo Point.

The soundings offshore are regular and increase gradually, making the lead the best guide as to the proximity of the land, which, being low, is not easily discerned, especially at night.

Mount Thetis, a remarkable peak of 5,828 feet high, known to the natives as "The Mountain," rises 30 miles inland from this part of the coast and is frequently seen from 70 miles at sea. From the summit the descent to the left is gradual for a short distance, but on the right is very abrupt, making a gap in the range of mountains.

Santo Domingo Point is a remarkable vertical rocky cliff of dark color, 175 feet high, backed by a mesa 400 feet high; the cliff extends several miles on either side of the point, the extension to the northward being a very remarkable white sand bluff. A small reef projects a short distance southwestward from the point, and the sea breaks heavily on the rocks at the foot of the cliff, making it dangerous to land except in moderate weather. The best landing place is on the open beach at the foot of the white sand bluff, avoiding rocky patches along and offshore.

Anchorage with some protection from the prevailing wind may be found eastward of the point in from 5 to 6 fathoms $\frac{1}{2}$ mile from the shore; but, owing to the heavy ground swell along this part of the coast, a vessel will have but little comfort in anchoring where there is less than 10 or 12 fathoms of water.

San Jose de Gracia Ranch, 16 miles northward of Santo Domingo Point and 10 miles from the coast, is situated at the head of an arroyo and is difficult of access, being completely surrounded by high mountains and table-lands.

The occupations are chiefly cattle herding and farming. Few supplies can be obtained, as there is but little left for commerce after the wants of the inhabitants have been supplied.

Coast.—From San Domingo Point to San Juanico Point, 264 miles, the coast consists generally of sand hills from 100 to 200 feet high, with table-lands and mountains farther inland; the famous peaks of the Sierra de la Giganta are distinctly visible from seaward, overtopping the intervening range of mountains.

Pequeña Point, 11½ miles southeastward from Santo Domingo Point, is rocky, with bluffs of volcanic nature 15 to 25 feet high, and a hill at the point, 60 feet high; a rocky shoal, over which the sea breaks, extends a short distance from the point. Outside the shoal the water deepens quickly, 20 fathoms being found ¼ mile from the point. About ½ mile northwestward from the extreme southern part of the point is a whitewashed stone beacon.

San Juanico Bay is formed by a deep indentation of the coast line castward of Pequeña Point, and affords a very gccd anchorage northeastward of the point, a mile from shore, in from 5 to 6 fathoms water, with shelter from the prevailing coast wind. Near the shore, at the head of the bay, is said to be a spring from which a trail, after skirting the coast for several miles, leads to the interior.

The general features of the section of country from San Juanico Bay to Magdalena Bay are level and rolling plains, high table-lands, and mountain peaks. At San Juanico Bay, where a high table-land ends in a steep bluff within 1 mile from the coast, the plains may be said to begin, but from here to the Pabellon Arroyo the country is very rugged and uneven, with undulating hills and low rocky table-lands; thence toward the south the table-lands gradually recede from the coast until they merge into the range of mountains that skirts the gulf coast.

The country is cut into sections by arroyos or watercourses, some of which have their scurces in the gulf coast range of mountains, while others rise 15 or 20 miles from the Pacific coast, where are found the mouths or "bocas" of all. The extent of the bars across these bocas depends upon the amount of rain in the interior; at the time of heavy rains the bars are washed away and the bocas opened, so remaining until the bars are again formed by the action of the sea.

The land rises toward the interior, at first gradually, and then abruptly for several hundred feet, to the tops of the white table-lands that extend like spurs between the valleys of the arroyos. Increasing gradually in width and height, these table-lands finally merge into the high table-lands of the interior, dotted with mountain peaks and separated from one another by the deep and narrow canyons into which the arroyos are contracted as the table-lands expand.

Trade.—There is but little trade with the outside world; the principal export is crchilla and the principal imports are cotton fabrics, tobacco, and breadstuffs. Cattle, oranges, lemons, figs, dates, wine, and mescal are the principal products. Cercals, potatoes, and tobacco are raised only in limited quantities. A native pepper called "oregano" is also a product.

Transportation is poor; pack trains of mules and burros are the common methods.

Rains are infrequent, but there are certain places where water can generally be found. At intervals of two or three years comes a season of heavy rains that flood the arroyos and cause them to run to the sea; at intervals of five or six years come still heavier rains that produce freshets.

Fogs.—Going south from San Juanico Point, fogs become more frequent, and the coast winds are not so strong.

Arroyo Mesquital has its origin between the mountains Quiñi and Toro, about 13 miles from the coast, partly divides the Cavallezara Mesa, and enters the sea through the Boca de Mesquital, 7½ miles southeastward from Pequeña Point. The first spring of water is found about 10 miles from the coast, at the foot of a sandstone bluff. From 1 to 2 miles farther inland is a succession of ponds containing good clear water. In this vicinity the valley gives pasturage to hundreds of cattle and horses.

San Juanico Point is a sand bluff about 50 feet high, resting on a bed of conglomerate. The point is bordered by a shoal which begins about 2 miles northwestward from it, extending offshore about 4 mile, and shoal water fills the bight eastward of the point. A dangerous shoal lies about ½ mile southeastward of the point, within the 3-fathom line; the sea breaks over the shoal at low water, and with a swell there is at all times a heavy roller that breaks occasionally.

Vessels may anchor southeastward of San Juanico Point in 5 to 6 fathoms and find some protection from the coast wind, but the anchorage is not recommended.

San Gregorio Lagoon, the San Juanico of former charts, has a narrow opening to the sea about ½ mile eastward of San Juanico Point, with a bar which, at highest spring tides, is crossed by small coasters of from 6 to 7 feet draft. The lagoon extends about 3½ miles to the northward, gradually narrowing, with depths of from 1 to 3 fathoms, and is much cut up by shoals and sand bars. Considerable orchilla is gathered near its shores. Observations in the northern part of the lagoon, at the mouth of the Purisima River, showed but two tides in the 24 hours.

Arroyo San Gregorio rises near the gulf coast, flows between the Cavellezara and the Purisima Vieja Mesas, and enters the lagoon of the same name at its head. Near the foot of Mount Subida Alta are several ponds and a cheese ranch.

Cadegomo, or Purisima River, rising near the gulf coast, flows in a tortuous course through narrow gorges and through valleys, and empties into the San Gregorio Lagoon, 2\frac{3}{4} miles from the entrance. The Purisima is an almost constant stream, and although at its ending it has only the dimensions of a small brook, some 12 or 15 miles from its mouth it has every appearance of a river. From here

toward its source one may go for many miles along a beautiful stream varying from 25 to 100 feet in width and from 1 to 10 feet in depth. On its banks and in its valleys thousands of horses, cattle, mules, and goats find pasturage. Oranges, lemons, figs, dates, and sugar cane grow luxuriantly.

The Purisima is called a river as distinguished from an arroyo, which is only a water course and becomes a river only during the time of heavy rains. After serving its purpose in relieving the country of floods, the arroyo becomes again a dry river bed with here and there a pond remaining. These ponds, called by the natives "posas," are natural reservoirs, and as a rule contain water from two to three years without being replenished by nature.

Coast.—From San Juanico Point to Cape San Lazaro, which lies 75½ miles due south from the point, the coast sweeps around in a gradual curve to the eastward, making an indentation 11 miles deep. About 20 miles below the point the hills and table-lands cease and a series of lagoons begin; thence to Cape San Lazaro the coast is low and sandy, with high land far in the interior.

Arroyo Pabellon, with its branches, drains the mountains and table-lands lying between the mountains San Besinte and Casa Vieja, and enters the sea through the boca of the same name. About 1½ miles from the coast is a cattle ranch, and a posa, of which the water, though slightly braskish, is potable.

Boca de Pabellon, 10 miles southeastward of San Juanico Point, is open to the sea only during a rainy season.

Arroyo Comondu rises about 22 miles from the Pacific Coast, runs through a narrow and tortuous canyon until it reaches the plains, whence it enters the sea through the San Andrecita Boca, 17½ miles southwestward from San Juanico Point.

In its course through the mountains the river is fed by numerous small springs, but the water is all consumed by the inhabitants of Comondu for irrigation purposes before it reaches the plains, or is there quickly absorbed by the dry porous earth, reaching the sea only after heavy and continuous rains. Near the mouth of the arroyo water strongly sulphurous in taste can be obtained by digging a foot or more into the soft earth.

Boca de las Animas, 25 miles southward from San Juanico Point and 8 miles from the San Andrecita, the northernmost of the three entrances to a series of lagoons that extends northward from Magdalena Bay, is \(\frac{3}{4}\) of a mile wide and is fronted by a shoal extending \(\frac{3}{4}\) of a mile offshore, over which the sea breaks. The lagoons lie parallel with the coast, being separated from the sea by ony a narrow strip of sand, and are connected with the bay and with one another; they are used by small coasting vessels of light draft, and vessels of considerable size can ascend them many miles above Magdalena Bay.

Weather.—South of Boca de las Animas, as far as Magdalena Bay, there appears to be a complete change in the weather. During the fall and early winter months fogs are very frequent, forming over the lagoons and Magdalena Bay and brought seaward by the easterly wind, which blows in the early mornings; the sea breeze drives the fog back again over the land, and it is not until about noon that the weather becomes clear. Light breezes from southwestward and norhwestward occur during these months, with a remarkably smooth sea; the weather is warm. Northers do not blow this far south.

Arroyo San Benancio rises about 22 miles from the sea, flows through a narrow and tortuous canyon between table-lands and mountains, and enters the northernmost estero of the lagoons 3½ miles above Boca de las Animas. San Jorje, near the mouth of this arroyo, is the head of navigation of the lagoons and the port of shipment for Purisima and Comondu, articles being brought here on pack mules and sent in boats to Magdalena. Water is brought to San Jorje from La Posa Grande, 4 miles distant, on the Arroyo San Benancio.

Boca de Santo Domingo, the middle entrance to the series of lagoons, lies 10½ miles south of Boca de las Animas, the intervening coast being a low, sand beach with occasional low hills and a few bushes. The best channel is through the middle of the entrance, and is plainly marked by the breakers on either side.

Arroyo de Santo Domingo rises in the Nombre de Dios Mountains to the southward of Pommel (Santa Cruz), traverses the plains, and enters the lagoon about 2 miles below Boca de Santo Domingo. Far back toward its source water is found in abundance, but in its course through the plains only in a few places. About 7 miles from its mouth is a watering place, and near by a cattle ranch.

Boca de Soledad, the southernmost and deepest of the three entrances to the lagoon, is 13½ miles south of Boca de Santo Domingo, and is marked on either side by a ridge of sand hills from 50 to 100 feet high. A shoal, over which the sea breaks, extends 3 miles southward and westward from its northern side.

Arroyo Soledad rises in the gulf coast range, passes in a north-westerly course through rolling and level plains, and enters the lagoon 5½ miles south of the Boca de Soledad. About a mile from the mouth are several large ponds in the river bed, and near them is a cattle ranch. The water of these ponds remains fresh for two years after the river ceases to run; recourse must then be had to wells. Six miles beyond the ponds is a productive ranch called Matancita.

General remarks.—From 1874 to 1894 many changes took place in the shoals and bars at the entrances of the lagoons, and such changes doubtless continue; a previous examination is therefore always essential before attempting to enter. At high water and in moderate weather the channels will generally be plainly marked by the smooth water between the lines of breakers; at low water and in heavy weather the breakers extend farther out and acress the entrances.

Wells can be dug on the plains fronted by the lagoons and from them a supply of brackish water obtained. The *Thetis* found no good water except in the pools of the Soledad Arroyo.

Coast.—South of Boca de Soledad the coast retains the same general character as north of it, being low and sandy as far as Cape San Lazaro. The soundings along this part of the coast are quite irregular. Nine miles northward of the cape is a wreck on the shore, and 2 miles off the wreck a narrow bank with from 6½ to 9½ fathoms water extends parallel with the coast about 7 miles.

Cape San Lazaro, 31 miles 163° from Boca de Soledad, is the northwestern extremity of a high remarkable-looking headland of volcanic origin, appearing when first sighted as an island. About this headland are bold rocky cliffs, and behind them rugged mountains, the highest being Mount San Lazaro. 1,275 feet high and visible 43 miles. Along the shore are numerous outlying rocks, those at the northwestern and southeastern points extending ‡ mile offshore.

From the cape proper the coast trends about southeastward, 3½ miles, to Hughes Point, a low rocky point, from which it turns abruptly northward for 2 miles to the mouth of the small Santa Maria Lagoon.

Breakers.—Capt. von Helms, of the steamer Orizaba, reports that when passing Cape San Lazaro he observed a heavy line of breakers running northward and in line with the extreme northern limit of the cape, a distance of 2 miles from shore; the extreme outer breaker was detached and about ½ mile farther out than the reef proper, though the whole reef appeared to consist of a number of detached rocks. H. O. chart No. 1493 shows soundings of 4½ and 6¾ fathoms, ½ mile and 1 mile respectively, north of the cape, which may account for these breakers. There appears to be no foul ground or shoal water outside of a mile from the cape.

The current off Cape San Lazaro sets southeastward with a velocity of 1 to 1½ knots an hour.

Thetis Bank, with a least depth found on it of 19 fathoms, lying 18 miles, 296° from Cape San Lazaro, is about 13 miles long and 3 mile wide within the 50-fathom line. The bottom is very uneven and mostly rocky, with many jagged rocks; sand, shell, and coral were also found. The bank abounds in fish.

Position.—The 19-fathom spot. on the south end of the bank, is in latitude 24° 55′ 30″ N., longitude 112° 36′ 15″ W.

Bank.—Between Abreojos Point and Cape San Lazaro, from 5 to 18 miles outside the 100-fathom curve, soundings of from 44 to 75 fathoms taken by several United States vessels indicate the existence of a bank or submarine ridge of considerable extent. The northern limit of the bank is some 50 miles southeastward of Abrejos Point, and the southern limit, in 75 fathoms, about 30 miles northwestward of Cape San Lazaro. Future development of the bank may bring its southern limit much nearer the cape, and possibly closely connect it with Thetis Bank.

A bank about 12 miles long and 6 miles in width, with a least depth of water of 10 fathoms over it, lies 25 miles west-southwest-ward from Cape San Lazaro.

Santa Maria Bay, a crescent-shaped indentation of the coast between Hughes Point and Cape Corso, has a width between these two points of 7½ miles and a depth within them of 4½ miles. A narrow strip of sand beach with low sand hills and a few bushes forms the western side of the bay and separates it from Magdalena Bay and the lagoons. The soundings in the bay are very regular, increasing from 3 fathoms near the shore to 20 fathoms in the entrance.

Anchorage will be found in the northwestern bight of the bay in from 5 to 8 fathoms, sand, ½ to ¾ miles from the beach, well protected by Hughes Point from the prevailing winds.

Cape Corso is a bold rocky point, fronted by white sand bluffs from 70 to 80 feet high, upon which, in marked contract, dark-colored hills rise abruptly to a height of 600 feet.

From Cape Coroso to Entrada Point the coast trends southeastward and is a succession of rock points and intervening sand beaches, with numerous detached rocks close to the shore. The land rises abruptly to heights of more than 1,000 feet, Mount Isabel, the highest peak, being 1,250 feet high. Between Red Point and Magdalena Point is an indentation of the coast 41 miles wide and nearly 4 mile deep.

Entrada Point, the southeastern extremity of the high and narrow peninsula that extends southeastward 10 miles from Santa Maria Bay, and the western entrance point of Magdalena Bay, is a domeshaped hill about 200 feet high, connected with the mainland by a narrow strip of sand and rock but a few feet above high water. Quite near the point are several outlying rocks from 10 to 20 feet high, and a reef over which the sea breaks, projects southeastward from it about 400 yards. Entrada Point has been recommended as a good fishing ground.

Redondo Point the eastern entrance point of Magdalena Bay and the western extremity of Santa Margarita Island, which forms the southern side of the bay, is a round rocky headland nearly 100 feet high, the land rising from it rapidly to a height of 841 feet at a distance of a mile, and to 1,691 feet at 5½ miles.

A reef, over which the sea breaks in all weathers, the outer end marked by a rock awash, projects 700 yards westward from the cape. At the beginning of the spring flood a heavy overfall, dangerous to boats, has been observed at least 400 yards from the extremity of the reef and where there are from 7 to 9 fathoms of water.

The entrance to Magdalena Bay, between Entrada Point and Redondo Point, is 3½ miles wide, and the channel between the reefs that project from either point is nearly 2¾ miles wide, with from 10 to 19 fathoms water and no hidden dangers. Sailing vessels, in entering the bay, should keep well up toward Entrada Point, as both the wind and the current tend to set them down toward Redondo Point.

Magdalena Bay is about 17 miles long, northwestward and south-eastward, and 12 miles wide, with an area of about 100 square miles outside of the 5-fathom line; a navigable channel connects its south-eastern end with another large bay called Almejas Bay. A series of lagoons, opening from the northwestern end, extends to the northward more than 60 miles, and whaling vessels are said to have ascended a distance of 40 miles from the bay. At the mouth of these lagoons are extensive shoals and sand bars with channels between them varying in depth from $3\frac{1}{3}$ to 8 fathoms. Several other lagoons open on the northern part of the bay, and shoal water extends from 1 to 2 miles from the northern and eastern shores.

The land bordering on the northern and eastern sides of the bay is flat, low, and sandy, and is covered with low bushes and cactus; low hills rise toward the interior. The only vegetation is that of the desert. The barrenness of the country around the bay and the scarcity of water are such that little or nothing can be grown.

A rough trail through a barren and almost level country leads to La Paz, distant about 115 miles.

Magdalena Village is on the west shore of Man-of-War Cove, 7½ miles northwestward of Entrada Point, and contains about 25 frame and adobe houses and 50 inhabitants. It is a port of entry with a customhouse and a collector of customs, who is also the chief of the port. The chief official of the town is the judge, who is subordinate to and under the jurisdiction of the presidente of Comondu, one of the two municipalities into which the southern department of Lower California is divided.

Commerce of the place is of little importance and, in view of the surrounding sterility, not likely to increase. The principle exports are orchilla and live turtles. Orchilla, a parasitic plant used in making a violet dye, is gathered from the country north and east of the bay, camps being established for the purpose.

Water.—It has been formerly stated that the only regular supply of fresh water is obtained about 40 miles from the bay, near one of the northern lagoons, small vessels making regular trips for the purpose of bringing it to the settlement. This was not the case in 1894 and 1895 while the *Thetis* was in this locality, the town's water supply, brackish and scarcely drinkable, being then obtained from a spring several miles north of the town.

There is a spring of brackish water near the beach on the northeast side of Santa Margarita Island, opposite Mangrove Island, and brackish water is also found a short distance southward and eastward of Howlands Bluff, northward of the town. There is a large spring a few miles north of Medanos Blancos, opposite the town of Magdalena. No other places near the bay are mentioned, and it is stated that southward of Boca de las Animas there is an absolute scarcity of water. It would seem that considerable allowance must be made for the quality of the water at the places where "fresh water" is marked on the charts of these localities. Water of inferior quality may be obtained by sinking a cask in the sand on the beach, as practiced formerly by the whalemen. This was done by removing the heads of the cask and working it down, removing the sand from the inside, until a sufficient depth was reached for the water to ooze in freely. The water obtained in this way was of a milky-white appearance and had to settle a few days before it became clear and drinkable.

Rain showers are of rare occurrence.

Man-of-War Cove Light.—Group flashing white, visible 10 miles, is exhibited at a height of 29 feet from a red iron column near a cabin at the root of the mole.

Supplies.—Fish, oysters, clams, mussels, and abalones abound in the bay and lagoons; curlew, ducks, and other game abound on the northern shore; deer are numerous. Wood may be obtained from mangrove bushes, of which there is a thick growth on the shores of the lagoons.

Communications.—A Mexican steamship line calls here twice a month from San Diego. There are two overland mails a month to and from La Paz.

Anchorage may be taken anywhere in the bay, except a short distance within the entrance, where depths as great as 22 fathoms are found. The best general anchorage for all seasons is in Man-of-War Cove, off the town, in 9 to 10 fathoms water, ½ mile from the shore, with the light bearing 274° and Mount San Lazaro just shut in by the first high land southward of Howlands Bluff. Anchorage in 13 fathoms will be found ¾ mile to 1 mile from the town, with Belcher Point and the right tangent of Cape Redondo in range 140° and the light 254°.

In the winter months, with southerly winds, good anchorage will be found in the southern part of the bay; the chart and the lead are sufficient guides.

Landing.—A wharf with landing steps extends from the shore near the houses in Man-of-War Cove, but in fine weather the beach is usually preferred, as it is sufficiently steep to permit of landing dry shod from ship's boats.

Currents.—The general direction of the tidal currents is north-northwestward and south-southeastward in the western part of the bay, becoming more nearly north and south between Delgada Point and the lighthouse and decreasing very materially in strength in Man-of-War Cove until it is nearly nothing close in shore and to the southward of the shoal southeastward of Delgada Point. In the eastern portion of the bay the flood current makes more to the westward and the ebb to the southward.

Tides.—The mean lunitidal interval for high water is 8h. 20m.; for low water, 14h. 28m.; the mean rise and fall of the tide is 4 feet.

The tides in the bay are regular and cause in the entrance tide rips and strong currents (from 1 to 2 knots an hour).

Directions.—In making for the anchorage in Man-of-War Cove by day no directions are necessary, the water after passing Entrada Point being clear and deep within \(\frac{1}{8} \) mile of the shore, except in the bight to the southward of Belcher Point, where shoal water extends nearly \(\frac{1}{2} \) mile from the shore and \(\frac{1}{2} \) mile outside the point. A line from Sail Rock tangent to the shore to the northward of the rock clears the outer edge of the sand spit near Belcher Point, and may be used as a safety range.

In the night, having rounded Entrada Point at a distance of ½ mile from the rocks, a course 348° parallels the line connecting the outer end of sand spit off Belcher Point with Sail Rock. When Mount Isabel, the first high land after entering and the highest peak of the range, bears 258°, the sand spit and Belcher Point having been safely passed, thence a course of 310° until Cove Point is abeam, after which the light will be a guide to the anchorage. Cove Point can be made out distinctly from the land behind it; the land behind the town is high with low land to the right.

A current of 1 to 2 miles an hour sets over the sand spit off Belcher Point.

Winds.—The prevailing winds are northwesterly and blow from this direction the greater part of the year.

Phenomenon.—A remarkable phenomenon, said to occur frequently in the bay, is the appearance of vast numbers of crustacea, resembling the shrimp, but not edible. They are from 1 to 2 inches long, giving the water a crimson color. The receding tide leaves the

shore covered with thick layers, on which the sea birds feed, and the stench arising from their decomposition fills the air.

Santa Margarita is a high barren island of volcanic origin, about 21 miles long and 4½ miles wide in its widest parts. The seaward face is hold and rocky, with high hills rising from it, except for about 6 miles in the middle, where the land is low and sandy and has the deceptive appearance of receding within the hills and forming a bay; this on former charts has been called Pequena Bay, and the apparent projection where the hills end on the northwest was called Cape Judas. This low land, gradually narrowing, extends across the island, which is here 3½ miles wide, causing it to appear at a distance as two islands, the apparent opening being sometimes mistaken for the entrance to Magdalena Bay.

About 5 miles southeastward from Redondo Point is a prominent white bluff, 200 feet high, ½ mile off which there are two submerged rocks, White Bluff Peak, 1,074 feet high, bearing 63°. A short distance southeastward of the low land are two remarkable peaks near the shore, 1,413 and 1,631 feet high, known as "The Sisters." Mount Santa Margarita, near the southeastern end of the island and the bay shore, is 1,858 feet high. There is a spring of brackish water on the northeast side of the island near the beach.

Point Tosco, the southern extremity of Santa Margarita Island, is sharp, bold, and rocky, with a reef, over which the sea breaks with great violence, projecting about 1 mile to the southward.

A pinnacle rcck, position and existence doubtful, with 14 feet of water over it, has been reported about 8 miles 199° from Point Tosco.

Wreck.—The wreck of a steamer lies in an upright position and apparently intact about ½ mile inside Point Tosco.

Anchorage, fairly good, may be found to the eastward of the cape in from 7 to 9 fathoms.

Cresciente Island, a low and very narrow sand island of crescent form, nearly 12 miles long east and west, forms the southeastern side of Almejas Bay and the southern side of Santa Marina Bay. Santa Marina Point, the western extremity, lies 3½ miles northeastward from Point Tosco and about a mile east of the easternmost point of Santa Margarita Island.

Rehuso Channel, the native name of which is Bocana de Estaquercs, lying between Santa Margarita and Cresciente Islands, is a mile wide, but filled with shoals and too intricate for any but boat navigation. A shoal extends about 1½ miles southeastward from Santa Marina Point, and between the shoal and Point Tosco are several shoal spots over which the sea breaks.

The tidal streams are strong in this channel, causing many tide rips and overfalls.

Almejas Bay forms a continuation of Magdalena Bay, being connected therewith by the deep navigable Marcy Channel. The bay is about 12 miles long, trending the same as Magdalena Bay, and 8 miles wide, with a deep-water area nearly 6 miles square. On the northern and eastern sides are extensive shoals, and the southeastern third of the bay is filled with shoals which block the Rehusa Channel.

Marcy Channel, connecting Almejas and Magdalena Bays, is about a mile wide between the shoals that line the shores on either side, with mid-channel depths of from 12 to 18 fathoms. From the channel to the deep water of Magdalena Bay, about 4½ miles, there is a least depth of 5½ fathoms, but 7½ fathoms may be carried by keeping near the southern shore.

The left tangent of the first point of land (no name), about 2 miles southward and eastward of Cisne Point, in range with second peak from right (1,631 feet), seen ahead bearing 150°, is an excellent range for this channel.

Santa Marina Bay, a southeastern extension of Almejas Bay, is 10 miles long in a nearly east and west direction, with a width diminishing from 4½ miles at the western end to ½ mile at the eastern end, where it is connected with the sea by a narrow and shallow passage, the Boca del Colorado. The bay is filled with shoals, through which winds a narrow and tortuous channel carrying about 2 fathoms for two-thirds the length of the bay and about 1 foot for the remaining third. The "Camino Real" passes near the east end of the bay and skirts the coast as far as San Jose del Cabo.

El Conejo Point, opposite the eastern end of Cresciente Island, is the western end of a low narrow peninsula lying parallel with the mainland and separated from it by the Rancho Bueno Lagoon, which is 7 miles long, very narrow, and navigable for boats about half its length. The point is backed by a dome-shaped mound about 50 feet high on the north side of the lagoon.

Coast.—From El Conejo Point to Lobos Point, about 90 miles, the coast has a general trend to the southeastward and is in general low, sandy, and barren, backed by a low rolling country 50 to 100 feet high, cut by gullies and arroyos, and, as Lobos Point is approached, by a high rolling country, 500 to 1,100 feet high, covered with cactus. In general, the land in the interior rises gradually toward the gulf coast, with here and there conspicuous tablelands. A road, the Camino Real, closely skirts the coast, and leading from it to the interior are numerous short branches, and at several points roads to La Paz. Ranches occur at frequent intervals, and the places where fresh water is said to be obtainable are numerous.

For about 60 miles from Conejo Point, the 100-fathom line closely parallels the coast at a distance of 10 to 12 miles. It then sweeps

outward and reaches a distance of 24 miles from the coast at a point 250° from Lobos Point, where the depth drops in less than a mile from 73 to 323 fathoms; thence the line turns northeastward and is perpendicular to the coast until within about 3 miles of it, when it again becomes parallel with the coast and continues in close proximity to it as far as Cape San Lucas.

Anchorage may be had in fine weather anywhere along this part of the coast in from 8 to 10 fathoms about a mile from the beach. The soundings are regular and there are no hidden dangers. Breakers extend some distance offshore.

Caution.—At night or in thick weather the lead should be frequently used along this part of the coast as the best means of ascertaining the proximity of the land, which is low and not easily discerned.

Marquis Point, 40 miles southeastward from El Conejo Point, is low and rocky, with low sand bluffs on either side and a reef of rocks projecting from it ½ mile to the southward. From Marquis Point to the southern end of La Paz Bay, 23 miles in a northeasterly direction, the land is low and flat nearly all the way, with a scanty growth of bushes, cactus, and stunted trees. From 7 to 11 miles eastward of the point are some isolated steep table-shaped hills, 500 to 600 feet high, known as Las Mesas.

Arroyo de las Palmitas is described as lying about 5 miles northward of Lobos Point, with a grove of palm trees at its mouth and a beautiful valley extending inland. The arroyo is not shown on the chart, but the description may refer to Arroyo de la Playita, 6½ miles north of Lobos Point.

Todos Santos River, a never-failing stream, flows through a fertile valley and reaches the sea about 1½ miles northward of Lobos Point. The point on the southern side of its mouth, known as La Poza Point, is the northern end of a table land extending from the vicinity of Lobos Point, and is a perpendicular bluff about 50 feet high, with numerous outlying rocks.

Todos Santos Village, on the bank of the river 2 miles from its mouth, occupies the site of the old mission of Santa Rosa, and is beautifully situated in this fertile valley, which enjoys the combined advantages of the temperate and the tropical climate, with few of the disadvantages of either. The village is surrounded by well-cultivated fields of sugar cane, and in its gardens are found the cereals and vegetables of the north together with the fruits of the south.

This is said to be an excellent place to procure fresh provisions and water. A road leads to the village from a sand beach about $\frac{1}{2}$ mile above Lobos Point.

Anchorage.—In moderate weather there is good anchorage in from 7 to 10 fathoms, sandy bottom, about ½ mile above Lobos Point and ¼ mile offshore, just within the range of Lobos and San Pedro Points.

Lobos Point is the northwestern extremity of Los Lobos, a high rocky promontory having a frontage of 1½ miles on the sea and, where highest, ½ mile from the shore, an elevation of 682 feet. The point projects at a sharp angle from a sand beach on the northern side, forming a small cove slightly protected from the swell. The best landing place is at the junction of the sand beach with the rocky point; even here the sand shifts at certain seasons, leaving the rocks uncovered. Before making a landing the natives often run their boats close to the rocks, where all but two or three jump out; the lightened boat is then taken through the surf at the place where the sand beach joins the point.

When approaching Lobos Point, the high mountains back of La Paz and the sharp peaks of the Sierra de la Laguna are plainly visible, La Aguja and El Picacho, the most northern and conspicuous of the latter range, being, respectively, 6,432 and 6,507 feet high.

The coast for 20 miles south of Lobos Point is in general a succession of sand beaches and rocky bluffs, the latter projecting slightly from the coast line. Off these rocky points are sunken rocks, but no hidden dangers were found outside of ‡ mile from the shore; the water in most places is deep close-to, but off the mouths of some of the arroyos shoal water or bars extend for a short distance. The sand beaches are very steep; at one place a depression of 24° was measured.

In moderate weather there is usually but one breaker on the beach; with the stern of a 30-foct whaleboat on the beach the bow is in 2 fathoms of water; landing is therefore dangerous even in moderate weather.

Immediately behind the coast the land is hilly, with high and broken mountains in the interior.

San Pedro Point, 2 miles south of Lobos Point, is a high, steep, and rock bluff, backed by a hill 618 feet high, ½ mile from the shore. Between the point and the southern end of Lcs Lobcs is a sand beach about ‡ mile long, behind which is San Pedro Ranch with a small cultivated area. The indentation has been called San Pedro Bay, but is too slight to be considered a bay. The rocky shore continues 1‡ miles to the southward of San Pedro Point; thence a sand beach extends 2 miles, nearly to Pescadero Point.

La Bocana, the mouth of a large arroyo, closed in the dry season, lies 2 miles southward of San Pedro Point; about 2 miles inland from La Bocana is the village of Pescadero, where may be obtained

beef, vegetables, and fruit, including alligator pears. Sugar cane is also grown, and the village has a sugar mill.

A mile southward of La Bccana is a fresh-water pond, fed by the surplus irrigation water from Pescadero; the water is rendered impure by the cattle, which stand in it during the day. The same may be said, however, of all unfenced streams and fresh-water ponds in the cape region.

Pescadero Point, about 4 miles to the southward of San Pedro Point, is rocky, with outlying ledges, and should not be approached nearer than 1 mile. Pehind the point is a conical hill 347 feet high.

Gasparino Point is a rocky bluff, 75 feet high, between which and Pescadero Point is a sand beach about 4 miles long. The point is surrounded by sunken rocks and should not be approached by vessels within ½ mile. Just to the northward of the point and ½ miles inland is El Palmar, a small settlement in a large grove of palm trees.

La Tinaja Point, about 9½ miles southward of Gasparino Point, is a rocky bluff, 75 feet high, over which rises rather abruptly a hill 541 feet high. Between these points are three arroyos, of which the northern one has on its banks a small settlement with some palm trees; the banks of the scuthern one are yellowish bluffs with cactus-covered slopes toward the hills; the mouth of this arroyo is called Boca de las Matancias, from a small settlement of this name on its banks, about 5 miles distant.

About 4 miles inland from La Tinaja Point is a conspicuous mountain, 2.367 feet high, called El Guatamote. Just to the southward of La Tinaja Point is La Tinaja Arroyo, which is full of "tinajas" or rocky basins, in which the water lodges; this probably accounts for the name of the point. A ranch of the same name lies about a mile back from the beach.

Cerro de la Playa, 4½ miles to the southward of La Tinaja Point, is a rocky bluff, 75 feet high, from which rises abruptly a conical hill 504 feet high.

Arroyo Candeleria.—About a mile northward of the hill is the Arroyo Candeleria, in which fresh water may be obtained by digging. On each side of the arroyo, near the beach, are ranches, and about 5 miles inland is Candeleria Village, with about 100 inhabitants; the coast read crosses the arroyo just behind the beach ridge. About 1‡ miles north of the arroyo, and 2‡ miles from the coast, is Calabasa Mountain, 1,770 feet high. The 100-fathom line is only about a mile from this part of the coast.

There is a ranch and fresh water ½ mile to the scuthward of Cerro de la Playa and ‡ mile inland. About 2½ miles southward of the point is a rocky red-colored bluff, 50 feet high, with numerous rocks at its foot; between this bluff and San Cristobal Point are the Arroycs San Cristobal and Suspiro.

Wreck.—A wreck, with masts showing about 10 feet above water, has been reported 2 miles 311° from San Cristobal Point and about 3 mile off the coast.

San Cristobal Point, about 5 miles southward of Cerro de la Playa, is a bold rocky bluff from 200 to 300 feet high; about 1½ miles to the eastward of it is a projecting spur of the hills, 795 feet high.

The coast from San Cristobal Point bends gradually to the east-ward for a distance of about 7 miles to Cabo Falso, and consists of steep sand beaches, behind which are sand bluffs of whitish color, from 150 to 300 feet high, covered with patches of low shrubs which appear dark in contrast with the white background. From these bluffs the coast range of hills rises gradually to a moderate height, decreasing somewhat toward Cabo Falso.

Cabo Falso, the southernmost point of Lower California, is a rocky bluff about 50 feet high, with many detached outlying rocks lying near the shore. The coast is bold and may be approached within ½ mile with 5 and 6 fathoms of water. Just to the eastward of the extreme southern point is a conspicuous sand slide. Immediately behind the point rises a conical hill terminating in two hills called the "Paps"; the western one is 696 feet high, and the eastern one a few feet lower.

Cabo Falso Light, flashing white, visible 23 miles, is exhibited at a height of 262 feet from a red octagonal tower 52 feet high near a keeper's dwelling also painted red. The light has been unreliable.

The coast from Cabo Falso to Cape San Lucas, a distance of about 4 miles, is a succession of sand beaches and bold rocky bluffs, against which the sea breaks heavily, even in the finest weather. Barren hills from 400 to 800 feet high rise immediately behind the beach. About \(\frac{3}{4}\) mile west of Cape San Lucas is a strip of sand beach, about \(\frac{1}{2}\) mile long, connected through a gap in the hills about 400 yards wide with the shore of San Lucas Bay. From the beach to the cape is a wedge-shaped mass of steep, rocky hills, of which the highest, La Vigia, is 500 feet high.

Cape San Lucas is a headland of fantastic shape, formed by two high, bold, and grotesque-looking rocks, with a number of smaller outlying rocks near them. The name, Los Frailes, by which they have been called, is not known to the natives, who refer to them simply as "The Cape." The western rock, connected with the wedge-shaped ridge of hills by a narrow strip of sand beach, is 291 feet high, of sugar-loaf shape, and has on its eastern side an archway through which the sea rushes with great force. The eastern rock is 222 feet high, with nearly vertical sides, and is the Cape San Lucas proper; off its eastern end, about 100 feet distant, is a rock about 8

feet high, surrounded by deep water and with 10 fathoms between it and the cape.

The rocks of the cape are of soft crumbling stone, with generally a thin, hard crust; a deposit of guano gives them a chalky-white appearance.

San Lucas Bay, a bight in the coast about a mile in width and depth northward of Cape San Lucas, affords anchorage with good shelter from northwesterly winds, but exposed to the sea from south around to east, and therefore exceedingly unsafe during the summer or wet season, when southeasterly gales are both frequent and heavy. The soundings in the bay are very irregular, and the water is very deep in the middle and close along the south and west shores, with moderate depths along the north shore.

San Lucas Village, situated near the northwestern shore of the bay, on level land, just behind a high ridge of sand hills, consists of about a dozen houses and 60 inhabitants, whose chief support is raising cattle; for this the country is well adapted, and there are some extensive ranches in the vicinity. Behind the village is a rolling country, with fertile valleys, rising gradually to ranges of high mountains. The customhouse has been abolished, as there is little or no trade.

The Pacific Coast Steamship Co.'s steamer no longer calls here, but calls instead at San Jose del Cabo, which has been substituted for San Lucas as a port of entry. A road along the coast connects the two places, the distance being about 16 miles.

There is plenty of game in the vicinity, and the countless numbers of turtledoves filling the woods are said to deserve especial mention. The streets and the yards of the houses are filled with vultures and buzzards, which to a stranger appear to be domesticated.

Anchorage.—The best anchorage is in the northern part of the bay, in 12 fathoms, about ½ mile from shore, with the old custom-house, the most prominent building in the town, bearing 286°. The western part of the bay is much better protected from the sea, but as the 50-fathom curve lies here within ½ mile of the beach the anchorage is good only for small vessels.

Landing places.—The usual landing place is in front of the old customhouse; farther to the eastward there is generally a heavy surf. The best landing place is in the southwestern part of the bay, and landing here is generally safe.

Tides.—The mean lunitidal interval for high water is 8h. 8m.; the mean rise and fall of the tide is 2.8 feet; the greatest rise and fall of the tide observed was 6.8 feet.

Supplies.—Good beef, poultry, and game can be obtained at moderate prices, but other forms of provisions are scarce. Water of

fair quality and wood are said to be obtainable. The best water is obtained from wells sunk in the bed of an arroyo about $\frac{1}{2}$ mile from the beach. The natives prefer barter to sale for money.

Directions.—Rounding the cape at a distance of 400 yards, there being deep water close-to, steer 335° and anchor in about 12 fathoms, ½ mile from the beach, with the old customhouse, the most prominent building in the town, bearing 286°. As the bank is steep, the lead should be on the bottom when the anchor is let go.

CHAPTER IV.

OUTLYING ISLANDS AND SHOALS OFF THE WEST COAST OF LOWER CALIFORNIA.

OFFSHORE ISLANDS AND SHOALS.

Cortes Bank, lying about 40 miles southwestward of San Clemente Island and in the direct route followed by the steamships from San Francisco to Mexican ports and Panama, within the 50-fathom curve, stretches about 17 miles in a west-northwestward direction, from latitude 32° 24′ N. and longitude 118° 59′ W. to latitude 32° 32′ N. and longitude 119° 18′ W., with an average and nearly uniform width of 3½ miles. The hard bottom is composed of white sand, broken shells, and fine coral at the southeastern part, and sand with broken shells at the northwestern part. Between the bank and the mainland are depths of over 1,000 fathoms.

The bank abounds in fish, among the varieties found here being red rock, whitefish, yellowtails, and fatheads.

Bishop Rock, the shoalest and most dangerous part of the bank, with but $2\frac{1}{2}$ fathoms of water over it, lies 5 miles from the southeast end, in latitude 32° 26′ N., longitude 119° 06′ W. From the rock to the west end of San Miguel Island the course is 324°, and the distance 118 miles; to Point Loma the course is 82°, the distance 96 miles. Around the rock the depth increases gradually, and at $2\frac{1}{2}$ miles in the general direction of the bank reaches but 15 fathoms.

The 10-fathom spot, about the middle of the bank, lies 5 miles 287° from Bishop Rock, and has an area of about ½ mile square within the 15-fathom curve. Northwestward of this shoal patch, with the exception of a 26-fathom spot about 3 miles distant, the depth for 7½ miles is nearly uniform at 49 fathoms, and between the shoal and Bishop Rock at 43 fathoms.

The current over the bank is variable, frequently setting against the strong northwest winds with a velocity of nearly 2 miles an hour and causing at all times a heavy swell; the sea breaks heavily on the Bishop Rock even in moderate weather. At other times the current has been found to run nearly as strongly in an opposite direction. In the detailed examination of the bank in 1856 the general set of the current was found to be southward and eastward,

and its greatest velocity 1½ miles an hour; but no statement was made concerning the prevailing wind. In passing over the bank at night its proximity has been indicated by the increased swell.

Cortes Bank was discovered in March, 1853, by Captain Cropper, of the steamship Cortes, and the position was closely determined by bearings of San Nicholas and San Clemente Islands. He reported the water in violent commotion and thrown up suddenly in columns at regular intervals of four or five minutes. At first he thought he saw breakers, as on a reef, but concluded that the disturbance was owing to submarine volcanic agency, a theory disproved by the specimens of the bottom. His depth of water diminished from 42 to 9 fathoms, which indicate that he was on the shoal patch about the middle of the bank and saw the breakers on Bishop Rock; the appearance described by him has since then been seen many times.

In 1855 the clipper ship S. S. Bishop of Philadelphia, struck upon the rock, since called by her name, and attention was called to the necessity of a detailed examination of the locality. This was made in 1856, when the bank was sounded out to the extent of 130 square miles. From the favorable conditions under which this survey was made, confidence is expressed that the Bishop Rock is the only one existing; but the difficulty of finding detached pinnacle rocks below the surface in a seaway makes it not improbable that others may eventually be found; the prudent navigator will therefore give this bank a good berth.

Cortes Bank is one of numerous submarine ridges that have been found along this coast, and doubtless many others await discovery.

Tanner Bank, to the northward of and parallel with Cortes Bank, has within the 100-fathom curve a length of 16 miles and a width of 4 miles. A 28-fathom spot near the middle of the bank, the least depth shown on the chart, lies 17 miles 356° from the Bishop Rock.

This bank, like the Cortes, abounds in fish, the varieties being the same.

A bank of uncertain dimensions has been reported in latitude 31° 59′ N., longitude 119° 05′ W. A sounding was obtained in this position of 50 fathoms, hard bottom; 10 miles 141° from this position another sounding of 60 fathoms was obtained; 3 miles farther in the same direction no bottom at 100 fathoms.

Guadalupe Island, the northern end of which lies 135 miles 256° from Point Antonio, is of volcanic origin, about 20 miles long north and south, and from 3 to 7 miles wide, and is traversed throughout its length by a chain of mountains, the highest of which, near the northern end, is 4,500 feet high. The shores are in general bold rocky bluffs, with detached rocks close-to, but, outside of ½ mile, there are no known dangers to navigation except a sunken rock on

the west side, about 4 miles north of the south point and $\frac{3}{4}$ mile offshore. Very deep water surrounds the island, there being 1,424 fathoms at 4 miles from its northern end, and 1,121 fathoms at $3\frac{1}{2}$ miles from its southern end; between the island and the mainland are depths of over 2,000 fathoms. The island can be seen in clear weather at a distance of about 60 miles, and when bearing east or west appears lower at the southern than at the northern end. Sailing vessels bound from San Francisco to the Gulf of California generally sight it, passing to the westward on account of the stronger northwest winds on that side.

The southern part of the island is very barren, but the northern part has some vegetation on the mountains, and several fertile valleys. There were numerous goats on the island in 1892.

Wood and water may be obtained from a small cove near the northeastern end of the island.

Off the south end of the island are two rocky islets. Inner Islet, 744 feet high, is separated from the island by a passage about ½ mile wide, in which are depths of 11 fathoms, with rocks under water and several rocks out of water; two detached rocks lie ½ mile from its southwestern side. Outer Islet, 677 feet high, is separated from Inner Islet by a deep channel ¼ mile wide.

Melpomene Cove, at the south end of the island, affords anchorage in 9 fathoms, sheltered from all but southerly winds. In 1892, a British naval vessel anchored in 14 fathoms with the southeast point of the island bearing 98° and the south extremity of Inner Islet 234°. Inner Islet must be well open of the southeast point before the cove will be seen. The best landing will be found in the northwest corner of the cove.

Northeast Landing.—It is possible to anchor close inshore off the Northeast Landing in 40 fathoms, but it is better to lie to farther offshore. In the bight itself the surf breaks so heavily that landing through it is dangerous, but a landing can easily be effected alongside the point of rocks at the south end of the beach. Care should be taken to avoid some outlying rocks that are just awash.

Position.—The north point of the island is in latitude 29° 10′ 50″ N., longitude 118° 17′ 30″ W.

Alijos Rocks, a dangerous group lying in the track of sailing vessels bound down the California coast, consist of four principal rocks and numerous smaller ones, extending about ½ mile, north and south, with a width of less than 200 yards, the whole, when seen at a distance, appearing like a ship under sail. The southernmost and highest of the four large rocks is 112 feet high, and the northernmost 72 feet high; the former is perforated in several places near its base and may collapse at no distant day. There are about 50 fathoms water at ½ mile east and west of the rocks and 36 fathoms at a little

greater distance northwest of them; depths of over 2,100 fathoms are found within 10 miles of the group and over 1,300 fathoms within 6 miles.

Position.—The position of the southernmost rock is in latitude 24° 58′ N., longitude 115° 48′ W. The group lies about 152 miles from San Roque Point, the nearest part of the Lower California coast, and about 190 miles from Cape San Lazaro. The rocks should be given a wide berth at night.

Reported islands and shoals.—Among the numerous shoals and islands reported to exist off the coast of Lower California as far as longitude 140° W. are the following: New, Maria Laxara, Paxaros, Passion, Cooper, and Henderson Islands and Gaspar Rock. Careful search in the years 1873 to 1875 failed to find these dangers or any indications of land near their assigned positions. Similar search by vessels of other governments has had the same result.

Rock.—A rock, about 10 feet high and 400 feet long, was reported in 1907 to have been seen in the position of latitude 24° 41′ N., longitude 116° 10′ W., about 27 miles 223° from Alijos Rocks.

CHAPTER V.

GULF OF CALIFORNIA — EAST COAST OF THE PENINSULA OF LOWER CALIFORNIA, WITH ADJACENT ISLANDS.

Remarks.—The east coast of Lower California, from Cape San Lucas to the Colorado River, except in a few places, is high and precipitous, the mountains rising abruptly behind it. Off the coast are numerous islands, with navigable channels between them and the mainland. The coast and the islands near it are generally barren, but there are some exceptions, among which are San Jose Island, the vicinities of Loreto, Mulege, and San Lucas Bay, and the valley of San Jose del Cabo.

The depth of water near the gulf coast of the peninsula is in general much greater than near the Pacific coast, but there are many places that afford anchorage with protection from the prevailing winds.

Winds.—The prevailing winds in the Gulf of California, from November to May, are from the northwestward; during the remainder of the year southeast winds prevail. In the upper portion of the gulf, moderate northwest gales are frequently experienced during the months of December, January, and February, generally lasting from two to three days. During the rainy season, from May to November, southeasterly gales may be expected at any time in the lower part of the gulf.

Occasionally (usually with an interval of several years between them) a local hurricane or cyclone, known as El Cordonazo, blows with great violence. These hurricanes occur at about the end of the rainy season and always blow from southeastward to southwestward. They are of short duration but tremendous force, and are accompanied by much lightning.

Weather.—During the greater part of the year the weather along the coast is fair and pleasant, the heat of the day during the summer months being made tolerable by the cool nights. The scarcity of rain is compensated for, in some measure, by frequent heavy dews. During the winter months the northwest winds passing over the snow-covered peaks of the Calamahue Mountains cause a quite low temperature in the northern part of the gulf.

Although the rainy season is said to be from May to November, but little rain falls during that period on the California Peninsula,

and the land is for the most part dry and hot. Unlike the eastern or Mexican coast of the gulf in this respect, the rains, except in the southern part of the peninsula, occur mostly in the winter months. Summer rains are almost unknown north of Carmen Island.

The year is divided into the dry and rainy seasons, the changes of which occur at variable periods. During the dry season the weather is always fine, the winds blowing regularly during the day from northwest to west, following the direction of the coast; they are replaced at night by a light breeze off the land or by calms.

The rainy season, which commences in June, is at first indicated by calms and light showers of rain. As the season advances the showers become heavier, and, instead of occurring only at night, they commence in the afternoon and terminate in very violent tempests, accompanied by thunder and lightning and violent winds from all points of the compass. This weather continues until the end of September, and it often happens that the season terminates with a violent hurricane, which usually occurs between the 1st and 5th of October.

These hurricanes, which always blow from southeast to southwest, are of short duration, but are of such violence and raise so tremendous a sea that nothing can withstand them. They are known in the country as Los Cordonazos de San Francisco. A vessel surprised by them in a roadstead is liable to founder at her anchors, or, breaking from her moorings, be driven ashore. At the approach of the Cordonazo the offing should be run for, or, if obliged to remain in the roadstead, an anchorage should be chosen where it will be easy to get under way at the first sign of the tempests's striking.

Although usually occurring about October 1 these tempests have been experienced as late as November 1, a fact which it is well to remember.

Currents.—The currents in the middle of the gulf set to the south-eastward; they are of little strength and are greatly influenced by the tides. Between Cape San Lucas and Tortuga Island the currents are very erratic and dangerous, especially off Carmen Island, where there is an inshore set of over 1 knot, and between Tortuga Island and Santa Rosalia the currents run in any direction, at times as much as 3 knots.

Off Cape San Lucas a strong westerly set may be experienced. The tides ebb and flow regularly along the coast, but the strength and direction of the tidal streams depend greatly on the prevailing wind, and increase in strength toward the head of the gulf; at the mouth of the Colorado River they frequently run with a velocity of 5 to 6 knots per hour.

Fish.—Nearly every species and variety of edible fish found in the waters of the Mediterranean or on the coasts of Europe, the West Indies, Atlantic North America, or Chile are found in the waters of Lower California in greater abundance than elsewhere. Their numbers are not only incredible, but many of them are of extraordinary beauty and brilliancy of color.

Swordfish of immense size are found in the waters of the gulf; they have been known to attack vessels and leave their swords in the timbers.

Sharks of several species abound in every bay and harbor; among them are the thrasher and the hammer-head. Some of the sharks of the upper gulf waters are said to be as large as medium-sized California whales and to weigh over 1,000 pounds. They are called "tiburones" and reach a length of 30 feet; they are very ferocious, and much dreaded by pearl divers, boatmen, and fishermen.

The "manta raya," a species of ray, is an immense brute of enormous strength, cunning, and ferocity, and is more the terror of the pearl divers than any other creature of the sea.

Another inhabitant of these waters is the octopus (devilfish), a gigantic mollusk, that is found in the rocky cavities along the shore, particularly in localities sheltered from the surf, where it lies quietly among the seaweeds watching for its prey. Its arms, which are furnished with flat disks or suckers, are from 10 to 20 feet in length. With these arms it seizes, envelops, and smothers its prey, which it afterwards devours at its leisure with a sharp, formidable bill.

Red water.—A very curious phenomenon of the gulf is the existence of extensive patches of red-colored water. A distinction has been made between the vermilion patches of the mouth of the gulf and the brick-colored and corrosive waters of certain portions of the upper gulf. The former he assigns to the presence of countless numbers of ciliate infusoria suspended some distance below the surface of the water; the latter, to the presence of great numbers of flagellate infusoria, the common noctiluca miliaris, floating on the surface of the water, giving it a milky red color.

Coast.—From San Lucas Bay, at the extreme southern end of the California Peninsula, the coast trends northeastward, 10 miles, to San José del Cabo Bay, with deep water in close proximity to the shore all the way.

Cabeza Ballena is a rocky point of dark-lead color, rising almost vertically to a height of 188 feet, with numerous outlying rocks close-to. Immediately behind the point a range of hills, one of the spurs of the Sierra de la Victoria, rises to a height of over 1,200 feet. Just to the westward of the highest part of the bluff, rising from the water line, is a conspicuous pointed cone-shaped rock. The same rocky formation extends 2 miles to the westward of the point, and there joins the steep sand beach of San Lucas Bay.

This point is called by the natives La Mojonera (the landmark), Cabeza Ballena being with them the next point to the westward, toward Cape San Lucas.

From Cabeza Ballena the coast, for 4 miles to the northeastward, is generally rocky and of moderate height; thence it recedes somewhat, and for a distance of $2\frac{1}{2}$ miles is low and sandy, sloping gradually to a mountain range a short distance inland, called the Sierra de San Lazaro. Near each end of this sand beach is a large arroyo with a ranch at its mouth, the ranches being called El Tule and El Bledido. The house of the latter ranch, the eastern one, is whitewashed, and the gable shows up well from seaward. After passing the strip of sand the coast is of rocky formation as far as Palmilla Point.

Santa Maria Hill, 3 miles northeastward of Cabeza Ballena, rises from the shore to a height of 465 feet. Westward of the base of the hill is a small cove where boats may land in moderate weather. The 100-fathom line is but a mile distant from this part of the coast.

Cerro Colorado, $5\frac{1}{2}$ miles northeastward of Santa Maria Hill and within $\frac{1}{2}$ mile of the beach, is 437 feet high and an excellent landmark, being the only formation of the kind between San Lucas and San Jose Bays. It is red in color, not sandstone, as formerly stated, but more like limestone, and is said to contain small quantities of gold.

Palmilla Point, 1½ miles northeastward of Cerro Colorado, is a low, bluff, rocky point, with numerous sunken rocks close-to, and forms the southwestern limit of San Jose del Cabo Bay. It is backed, at a distance of 600 yards, by a mound 353 feet high. Northward of the point is a sheltered cove where boats land in front of a ranch house.

San José del Cabo Bay is an indentation of the coast, 9 miles long and 1½ miles deep, between Palmilla and Gorda Points. The shore consists of steep sand beaches, with rocky patches at either end of the bay, the patch near Palmilla Point being the more extensive. Moderately high hills rise a short distance inland, and the mountain range of San Lazaro rises farther back to the northwest; the remarkable thumb peak of San Lazaro, 5,111 feet high, standing like a pinnacle, is the highest of the range.

The bay in entirely open to the south and east, and the sea breaks heavily on its shores. The heavy swell that sets into the bay at all times, and particularly during the season of the southeast gales, from May to October, makes it an uncomfortable anchorage, and renders landing in ordinary ship's boats a hazardous undertaking. The anchorage being near the shore, and the bottom bad holding ground, it would be difficult for a sailing ship to get out with the wind on shore; such vessels should, therefore, not frequent this bay

except during the fine season, from November to May, when north-westerly winds prevail.

San José del Cabo Bay Light.—Group occulting white, visible 13 miles, is exhibited at a height of 56 feet from a white wooden tower, with dwelling attached, on Mirama Hill. This light was reported unreliable in 1916.

A sugar mill with a detached chimney is located about 219 yards northward of the light.

Anchorage may be found anywhere in the bay at a distance of $\frac{1}{3}$ mile from the beach, in from 6 to 10 fathoms of water, sand bottom, except just south of the customhouse, where a tongue of deep water approaches the land, with a depth of 50 fathoms within $\frac{1}{2}$ mile of the shore. The best anchorage is about $\frac{3}{4}$ mile northward of Palmilla Point, in 8 to 9 fathoms, abreast a strip of sand beach about 200 yards in length, fronting a rocky formation. The landing place in this part of the bay is in the small cove $\frac{3}{8}$ mile northward of Palmilla Point; landing elsewhere in the western part of the bay is dangerous.

The usual anchorage and that of the mail steamer is near the landing place for San José. To reach it, coming from the westward, round Palmilla Point at about ½ mile and steer 38°, anchoring in from 9 to 14 fathoms, ½ mile from the beach, with the lighthouse bearing 296°.

The customhouse is a small wooden building with a striped roof, on the site of the *Narragansett's* observation spot.

The best landing is on the beach southwestward of the customhouse, between two sheds, used for goods to be shipped by steamer. The surf either eastward or westward of this place is generally bad, and a landing can be made here when unsafe 200 yards either side of it. The landing place may change during the rainy season, when the lowlands back of it are flooded.

At the landing place, horses to ride to the village may be procured, with native guides to point out the best places for fording the water-courses. There is generally no delay in getting horses here, as the natives are on the watch for landing parties, and bring them down at once.

San José River waters an extensive valley of the same name, which extends many miles into the interior, and empties into the sea a little over 3 miles from Palmilla Point. Ordinarily the water only percolates through the high sand ridge at the mouth of the river, thrown up by the action of the sea, breaking through it only at the times of freshets.

San José del Cabo Village is on the west bank of the river, about $\frac{1}{6}$ mile from the sea, an extensive salt marsh, known as the Salatea, lying between the village and the beach. There are about 2,000

inhabitants, very few of whom are foreigners. The business of the place consists in shipping native products to adjacent ports and to San Francisco. Some of the natives are engaged in the shark fishery and the preparation of shark oil. There is also plenty of rosewood and cedar growing on the mountain sides.

San José Valley is one of the most fertile of Lower California. Throughout its extent are plantations of sugar cane, cotton, corn, and tobacco, and in its gardens are groves of orange, lemon, fig, lime, and pomegranate trees, while plantations and bananas grow by the side of every ditch or aqueduct. Here and there are groves of palm trees.

Supplies.—Vessels may obtain fresh meat, vegetables, and wood. Water may be obtained near the mouth of the river.

Communications.—Steamers of the Compañía Naviera del Pacífico Line call at San Jose del Cabo three times a month from San Diego.

Tides.—High water, full and change, is at 8h. 27m.; the mean rise and fall of tide is 2.8 feet.

Position.—The semaphore on the hill south of the town, $\frac{3}{8}$ mile from the shore, is in latitude 23° 2′ 54″ N., longitude 109° 41′ 29″ W.

Road to La Paz.—A road from San José del Cabo, passing through the valley and winding around the numerous spurs of the Sierra de San Lazaro, leads to Santa Anita, La Palma, Miraflores, Santiago, Los Martires, and Buena Vista, on Palmas Bay; thence up a canyon to Santa Bartolo, San Antonio Triunfo silver mines, and La Paz. For making this journey of somewhat over 100 miles, horses and mules can be obtained at San José.

The road from San José to Buena Vista may be traveled by cart; the other roads in the cape region are pack-mule trails. Cattle paths lead up most of the mountains.

Gorda Point is a round rocky bluff, about 50 feet high, with many outlying rocks close-to; from it rises a rather flat-topped hill, 311 feet high. About 2 miles west of the point and ½ mile from the shore is a cluster of three conspicuous hills, the westernmost, 722 feet high, called Los Picachitos. They are of gray color and conical shape, resembling small craters, and can be distinguished at a considerable distance; coming from the westward, they can not escape notice before entering San Jose Bay.

A shoal with from 3 to $4\frac{1}{2}$ fathoms over it lies 700 yards southeastward of the point, which should therefore not be approached within $\frac{1}{2}$ mile; the water deepens rapidly to 17 and 19 fathoms at $\frac{1}{10}$ mile.

Gorda Banks.—About 5 miles, 131°, from Gorda Point is Inner Gorda Bank, on which a least depth of 17 fathoms was found. At 2.7 miles outside of Inner Bank is Outer Gorda Bank, on which the least depth found was 34 fathoms. On the two banks the bottom is

rocky and irregular; around and between them is a depth of over 100 fathoms.

Coast.—From Gorda Point the coast sweeps gradually around to the northward as far as Los Frailes, a distance of 21 miles, without any intermediate prominent points that are recognizable from a distance. It is rocky and moderately low, with occasional sand beaches, sloping gradually to the mountain range in the interior.

There are many sunken rocks along all the shore, but no known dangers outside of ½ mile from the beach; the surf is often bad. The natives, knowing the passages between the sunken rocks close to the shore, land boats at Zacaton ranch, 1½ miles northward of Gorda Point.

Cardencito Point, 4 miles northeastward of Gorda Point, is low and rocky, projecting but little beyond the general coast line; upon it at all times breaks a heavy surf.

Boca del Tule Point, 8 miles northeastward of Cardoncito Point, is a bold rocky bluff, 60 feet high, recognizable by its light-grayish color, differing several shades from other points in the vicinity. Off the point are numerous detached rocks close-to. At the Boca del Tule, just above the point, boats land in good weather. Arroyo de la Vinorama opens on the coast a mile southwestward of Boca del Tule Point, with a wide sandy mouth. About 1,500 yards inland a stream of good water sinks beneath the surface of the arroyo.

Shoal water.—About midway between Cardoncito and Boca del Tule Points, where a lateral spur of the coast range of hills ends near a low sand beach, between the Arroyo del Manto and the Arroyo de San Luis, the water is discolored more than a mile off-shore, and is shoaler than on other parts of this section of coast; there are 12 fathoms at a mile, and 17 fathoms at 1½ miles. From the vicinity of Gorda Point the 100-fathom line curves gradually outward until it reaches here a distance of 7 miles from the coast, and then curves shoreward, approaching within a mile of Boca del Tule Point.

The Arroyo de las Ardillas and the Arroyo del Salado open on the coast at 2 miles and 3½ miles, respectively, from Boca del Tule Point. At the mouth of each arroyo is a ranch.

Los Frailes.—This headland or cape is a bold rocky bluff of a light-grayish color, 410 feet high, backed by a hill 755 feet high; the name also includes the cluster of peaks inshore of the cape; between this headland and the coast range of hills the country is low.

Just south of the cape is a small bay, extending $\frac{3}{4}$ mile within the point, at the head of which is an arroyo and a ranch. The water off the cape and in the bay is very deep, over 10 fathoms being found within 200 yards of the beach; but a fair anchorage, with protection from the northerly winds and sea, may be found just off where the rocky hill joins the sand beach; here, 9 or 10

fathoms, rocky bottom, will be found 1 mile from the shore. Farther westward the depth increases very rapidly. Shoal water and breakers extend less than 1 mile off the southeast point of the bay.

There is a small white rock, 12 feet high, with 12 fathoms of water close-to, 1½ miles northward of the cape proper and ½ mile from the nearest shore.

Cape Pulmo, 4 miles northward of Los Frailes, is a high bluff, from 50 to 75 feet high, backed, \(\frac{3}{4}\) mile within the extreme point, by a hill, 830 feet high, which is the eastern end of a range of mountains from 1,500 to more than 2,000 feet high. Off this rocky headland shoal water extends a short distance in every direction, and close to it are numerous detached rocks. The extreme rocky point, or cape, is connected by lowland with the hills behind it.

Between Los Frailes and Cape Pulmo the coast consists chiefly of sand bluffs about 20 feet high, with some rocky patches and a few outlying rocks along the shore. Just south of Cape Pulmo is a ranch, the only settlement near by, which, like the high bluff of the cape itself, is known to the natives and masters of coasters as El Pulmo.

El Pulmo Reef.—From the shore southward of El Pulmo ranch house a coral reef projects in a northeasterly direction, and ends about ½ mile east of Cape Pulmo, in 10 feet of water, the depth increasing rapidly 2, 3, and 4 fathoms. Between the reef and the cape is a small harbor, good for boats and small vessels, into which $2\frac{1}{2}$ to 3 fathoms may be carried; the channel lies between the end of the reef and the point.

El Pulmo Shoal, on which a least depth of $5\frac{1}{2}$ fathoms was found, lies about $1\frac{1}{4}$ miles 50° from Cape Pulmo.

Coast.—Between Cape Pulmo and Arena Point the coast recedes considerably, forming an open bay, extending within the points 1½ miles, with sandy shores, becoming low toward Arena Point.

Shoal.—About 2 miles 344° from Cape Pulmo and 800 yards from the nearest shore to the westward is a shoal about 1 mile long on which the sea breaks, with a least depth found of 8 feet.

Directions.—To avoid the dangers in the vicinity of Cape Pulmo, vessels bound to the northward should not approach the shore within 1½ miles, after passing Los Frailes, until Cape Pulmo bears 223°, when they may haul up for Arena Point, or the anchorage under the point. Vessels bound to the southward should steer so that when Cape Pulmo bears 223° the end of Los Frailes shall bear nothing to the eastward of 186°, keeping seaward of the latter bearing until Cape Pulmo bears 234°.

Arena Point is low and sandy, with a heavy surf breaking all around it, but no outlying dangers; to the eastward of the point the water is very deep close-to, the 100-fathom line being but about

 $\frac{1}{2}$ mile distant. The water shoals rapidly northward of the point, which should not be rounded at less than $\frac{1}{2}$ mile, though it may be passed close-to.

Fair anchorage may be found in northerly weather, in 8 to 10 fathoms, sand, about ½ mile offshore, with the end of Arena Point bearing 9°, distant about 1 mile. Small vessels anchored closer in to the westward. Within the 5-fathom curve the water shoals rapidly. Near this anchorage is Las Lagunas ranch, and 3 miles southward of Arena Point is Los Tezos ranch, off which vessels may also anchor. Tides rise about 4½ feet.

Near Arena Point is quite an extensive plain covered with cactus and various kinds of bushes and trees; among the latter is the copal tree, which is found in many places in the southern part of the peninsula.

Palmas Bay.—From Arena Point the coast trends in a general west-northwestward direction, 14 miles, to the village of Buena Vista, and thence turns northward, 8\frac{3}{4} miles, to Pescadero Point, forming Palmas Bay, which is 19\frac{1}{4} miles wide between the points and extends 5\frac{1}{2} miles within them. The bay affords no shelter to the southeasterly gales, being entirely open to easterly winds. In the northern part of the bay deep water extends up to the shore, and the hills rise from the water with rocky cliffs and stony beaches; in the southern part the water is shoaler and the coast is less broken, the land rising gradually from the law sandy shores to the coast range of mountains.

Colorado Point, 3½ miles westward of Arena Point, is steep and rocky, with detached outlying rocks close-to. Shoal water extends about a mile eastward of the point and fills the bight southward of it. About 1½ miles 306° from Arena Point is a 2½ fathom spot, with deeper water nearer the shore. Between Arena and Colorado Points vessels should not approach the shore nearer than 1½ miles.

Boca de la Trinidad, mouth of the arroyo of the same name, opens on the bay, 6 miles northwestward of Arena Point, near a cluster of conspicuous hills; near it is an extensive ranch.

Soledad Point, $7\frac{1}{2}$ miles northwestward of A1ena Point, is low and sandy, and projects but little beyond the general line of the coast. Near this point are a number of scattered ranch houses and La Rivera village, where fresh vegetables, beef, and other supplies may be obtained. Deer are numerous in this vicinity, and on the flats behind the beach are fresh-water ponds abounding in waterfowl. About $3\frac{3}{4}$ miles westward of the point and $\frac{1}{2}$ mile inland is Los Martires ranch, and, near by, Capilla sugar mill.

Buena Vista village stands on the shore, 6 miles westward of Soledad Point. Large vessels should approach the village slowly and keep the lead going, as the water shoals quickly from 15 fathoms to 5 and 4 fathoms. Small vessels anchor close in, to load. Vessels

are said to ride out here fresh onshore breezes; but with a gale coming on from northeast to southeast they run for a lee under Ceralbo Island.

Post office.—The road from San Jose, through Miraflores and Santiago for Triunfo and La Paz, touches the coast at Buena Vista, where there is a post office. Daily mail is sent from La Paz by automobile to Triunfo, and then on by horse to San Jose del Cabo and Cape San Lucas. Boats land in front of the post office and at other places in this vicinity.

Coast.—Northward of Buena Vista there is deep water close to the shore, and no anchorage until close to Pescadero Point. Along the shore are several ranches, and off one of them, 2 miles southward of Pescadero Point, vessels sometimes lie without anchoring, the water being too deep, and send ashore to the ranch, where beef may be quickly obtained. Piedras Gordas and Boca San Bartolo are, respectively, \(\frac{3}{2}\) mile and \(1\frac{1}{2}\) miles northward of Buena Vista. About \(2\frac{1}{2}\) miles southward of Pescadero Point are the ruins of a stone building.

Pescadero Point is bold, rocky, and of reddish color, backed by a hill 858 feet high. The water off the point is, in general, very deep, but a 5-fathom spot lies less than $\frac{1}{2}$ mile eastward of it, and the bottom near the point is rocky and irregular; vessels should therefore not approach the point nearer than $\frac{1}{2}$ mile.

Anchorage.—About $\frac{1}{2}$ mile southward of Pescadero Point, close inshore, is an anchorage for small vessels, with some protection from the northerly winds and sea.

Muertos Bay is similar to Palmas Bay, being formed by a wide indentation of the coast, about 4 miles deep, between Pescadero and Perico Points. Back from the bay the land rises to a height of 3,600 feet, with a gradual ascent on the southern side from a sand beach and on the northern side from a broken, rocky shore. The most prominent peak, 3,600 feet high, in this coast range of mountains, is about 41 miles from the shore of the bay.

At the head of the bay, and in the northern part, the water is deep close to the shore; in the southern part, anchorage can generally be had in from 6 to 10 fathoms, sand, within ½ mile of the beach.

Near the shores of the bay are several ranches.

Perico Point is a steep, rocky bluff, of whitish color, 40 to 60 feet high, behind which rises abruptly a hill 623 feet high. The water is deep close to the point, 10 to 14 fathoms being found at 200 to 300 yards, and 135 fathoms at ½ mile.

Perico anchorage.—Southward of Perico Point the steep and rocky formation extends about 2½ miles, at which distance is a small cove with a sand beach on the western and southern sides. There is

good anchorage, in 8 to 10 fathoms water, off the sand beach in the bight, with complete protection from the northerly winds and sea.

Point Arena de la Ventana.—The coast northward of the rocky bluffs of Perico Point recedes a little, and is low and sandy to Point Arena de la Ventana, which is a low sandy point, the eastern limit of Ventana Bay and the south point of entrance to Ceralbo Channel; behind it, to the westward, is a low sandy plain, gradually rising as it extends inland.

Ventana Bay, lying between Arena de la Ventana and Gorda Points, is 12½ miles wide between the two points, and extends 6½ miles within them. The southern shore of the bay is low and sandy, with an extensive plain behind it, covered with cactus and stunted bushes. On the western side the high coast hills rise more abruptly from the water's edge, forming, with the high peaks of the interior, a continuous stretch of mountainous country extending to La Paz Bay. North and South El Mulato, the two highest peaks, 3,829 and 4,144 feet high, lie 7½ miles southwestward from Point Gorda; they are a mile apart, and visible from a great distance.

The bay is much frequented in the proper season by vessels engaged in the pearl fishery.

La Ventana is a small village, now in ruins, near the shore of the bay, $9\frac{1}{2}$ miles westward of Point Arena de la Ventana. There is a road from the village to San Antonio Triunfo silver mines, a distance of 15 miles; at one time the products of the mines, now taken to La Paz, were brought to La Ventana for shipment. No supplies can be obtained here.

Anchorage may be found in any part of the bay within $\frac{1}{2}$ mile of the shore in from 5 to 8 fathoms water; farther offshore the water deepens rapidly.

Point Gorda, the western limit of Ventana Bay, is a bold rocky bluff, 50 to 75 feet high, with high land immediately behind it. It may be safely approached to within a short distance, 5 fathoms of water being found close-to.

Ceralbo Island, which lies to the northward of Point Arena de la Ventana, is of volcanic origin, high and barren; it is 15½ miles long in a nearly north-northwest and south-southeast direction, and its greatest width is about 4 miles; it is said to contain rich copper mines. Several high peaks rise to the height of over 2,300 feet; the highest and most northerly peak, 2,518 feet high, is about 7 miles from the northern point of the island.

The whole eastern face of the island is a succession of bold rocky bluffs, with small stretches of gravel beach intervening and with deep water close to the shore. From the northernmost point, which is a high bluff, a reef of rocks projects nearly 1 mile. Small vessels,

especially those engaged in the pearl fishery, frequently anchor to the eastward of and close under this point, which affords some protection from the strong northwest winds.

Seal Rock.—Four miles, 333°, from the northernmost point of Ceralbo Island is a rock of about 100 feet long, 50 feet wide, and 12 feet above water, known as Seal Rock from its being a favorite resort of these animals. On the northwestern side of this rock, something less than 100 yards distant, is a smaller rock, awash at low water, and at 200 yards 203° is a sunken rock with only 2 fathoms water over it. There are a few smaller rocks in the immediate vicinity, the whole forming a dangerous group.

Seal Rock is called by the natives La Reina.

Channel.—Between this group of rocks and Ceralbo Island is a deep channel, believed to be free from dangers. At ½ mile from Seal Rock 25 fathoms were obtained, the depth increasing to over 100 fathoms at 1½ miles.

The northwest point of Ceralbo Island ends in a reef of rocks fronting a bluff point and projecting but a short distance. The western side of the island presents nearly the same appearance as the eastern—bold rocky bluffs, wherever the steep lateral spurs of the main ridge approach the shore, with sand and gravel beaches intervening.

At 4½ miles from the northwestern point there is a slight indentation in the shore line, with a strip of sand beach at the bottom of the bight, known as La Limoña, and 3 miles farther south a similar indentation is known as El Mostrador. The southern limit of El Mostrador is formed by a steep high bluff of a whitish color, called Farallones Blancos; 2½ miles southward of this bluff is a bold rocky point called Carrera de los Viejos. The next point to the southward is low and sandy, and forms the southwestern extremity of the island; the water off this point is very deep, but anchorage may be found on the north side of it, 400 yards from the shore, in 10 fathoms water. Three-quarters of a mile southeastward from the lastmentioned point is a bold rocky point called Piedras Gordas, off which a reef of rocks projects about ¼ mile; from this point the distance is a little over 3 miles to the southeastern point of the island, which is a steep rocky bluff.

Montana Rock, a dangerous sunken rock with only 4 feet of water over it at low tide, lies about \(\frac{3}{4} \) mile off the southeastern point of the island, the easternmost point bearing 0°, and Piedras Gordas 288°. Between the rock and the island is a clear passage with 5 and 6 fathoms water; outside the rock the water deepens rapidly, 10 fathoms being found in close proximity.

Ceralbo Channel, between Ceralbo Island and the mainland, is 3\frac{3}{4} miles wide at Point Arena de la Ventana, and 6\frac{3}{4} miles wide at

Point Gorda. The water is too deep for anchorage except near the shores.

Directions.—In using this channel with a steamer, it is only necessary to keep in mid-channel. Montana Rock, the only danger not close to the shore, is easily avoided by keeping toward the southern side of the entrance. El Mulato Peaks, bearing 270°, lead well to the southward of the rock.

The above directions apply equally well to sailing vessels having a fair wind. With a head wind they should not attempt to pass through the channel, as the tidal streams run with considerable strength, sometimes $2\frac{1}{2}$ knots an hour, and nothing would be made beating against them. Calms are also frequent in the channel, and as a rule sailing vessels bound to La Paz will do better to go well outside of Ceralbo Island.

Caution.—Unless well acquainted with the coast, it is not advisable to attempt to pass through the channel at night or in thick weather.

Coast.—The coast between Point Gorda and Coyote Point, a distance of $16\frac{1}{2}$ miles, is generally bold and rocky, with occasional sand beaches. Behind the coast the country is broken and mountainous.

Point Santa Cruz, 5 miles northwestward from Point Gorda, projects but slightly from the trend of the coast, with no outlying dangers. About a mile southeastward of the point is a ranch where good water may be obtained.

About 5½ miles northwestward from Point Santa Cruz a sand spit projects ½ mile offshore, with a large white rock 50 feet high near its outer edge.

Rosario Bay, the southern one of two bays formed in the coast line between Point Santa Cruz and Coyote Point, is $2\frac{1}{2}$ miles wide, with 4 fathoms water close to the western shore and 15 fathoms in the center. At the deepest part of the bight, near the shore, is a ranch known as San Rosario. Just north of this ranch a shoal extends a short distance from the shore. At the northern end of the bay is a rocky bluff with a conspicuous hill 984 feet high just behind it. From here to Coyote Point, 5 miles, the coast line curves somewhat inward and the hills recede considerably from it. Just before reaching Coyote Point, when coming from the southeastward, a bold rocky bluff with moderately high hills is passed. This bluff is frequently taken for Coyote Point, which is about $\frac{1}{2}$ mile northwestward from it.

Coyote Point, the southeastern entrance point of San Lorenzo Channel, is moderately low and rocky, with a small outlying white rock close to, and a reef of rocks projecting a little more than 200 yards from the point.

Las Galeras.—Two miles to the westward of Coyote Point, a shelving rocky ledge, called Las Galeras, makes off from a bluff point about ½ mile.

Arranca Cabello Point, about a mile to the westward of Las Galeras Point, is a steep rocky projection, backed by a hill 164 feet high. A small shoal with 2 fathoms of water lies about # mile north-westward of this point; between the shoal and the point is a passage with 2½ fathoms of water.

San Lorenzo Point, 15 miles southwestward of Arranca Cabello Point, is the northwestern extremity of the peninsula that forms part of the eastern shore of La Paz Bay. It is a moderately high bluff with shoal water extending about 400 yards off it.

Espiritu Santo Island, which forms the northern side of San Lorenzo Channel and part of the eastern side of La Paz Bay, is of volcanic origin, 12 miles long and from 2 to 5 miles wide, with numerous peaks, the highest of which is 1,951 feet high. Copper mines of great value are said to exist on this island.

Lupona Point, the southern extremity of the island, is low and sandy; toward the hills to the northward are a few scattered bushes. As far as Bonanza Point, the next point to the northeastward, the coast consists of alternate sand beaches and bluffs. North of Bonanza Point, which is a rocky bluff with a flat-topped hill of moderate elevation just behind it, the coast is a succession of white sand cliffs for about 13 miles, at which distance there is a mound of bowlders close to the shore; the coast line here makes a sharp turn to the east for mile, when it turns again sharply to the north; off the point formed by this last sudden change in direction, a reef of rocks, many of them above water, projects 1 mile; in the bight southward of this point anchorage may be found in 5 or 6 fathoms, protected from the northwesterly winds. Bonanza Point, as given on the chart and herein described, is called by the natives Morito Point; with them Bonanza Point is the next one to the northeastward, not named on the chart, off which projects the reef just mentioned.

Lobos Point, the easternmost point of Espiritu Santo Island, is a high rocky bluff, with the land rising abruptly behind it; deep water extends close up to the shore. From Lobos Point the coast falls away, trending about northwestward to the north end of the island; it is generally bluff, with short stretches of sand beach. About 4 miles northweatward of Lobos Point there is a rocky point off which a reef of rocks projects \(\frac{1}{2}\) mile. Here the general coast line is broken by an indentation 1\(\frac{3}{4}\) miles deep and a mile wide at its outer part, which, with a corresponding indentation on the western side, nearly divides the island.

Isla Partida, the name given to that portion of the island lying north of the two indentations or coves just spoken of, is joined to

the main part of the island by a neck of land less than 300 yards wide and of moderate height. The northern point of the island is a rocky bluff.

Los Islotes are three rocky islets lying about ½ mile off the northern point of the island; two of them are from 50 to 60 feet high, with perpendicular sides and flat tops; the third is merely a large rock about 5 feet above water, lying to the westward of the other two; they are separated from the island and from one another by narrow channels, navigable only by boats.

The western side of Espiritu Santo Island is in general character similar to the eastern side, rocky bluffs predominating. About 2½ miles from the north end is a small inlet known as El Cardonal; ¾ mile farther south is the cove or indentation already mentioned in connection with a similar one on the eastern side of the island. In the cove on the west side there is said to be snug anchorage for small vessels.

Ballenas Island lies about midway between the northern and southern ends of Espiritu Santo Island, separated from it by a channel a little more than ½ mile wide, with from 3 to 8 fathoms of water. The island is about ¾ mile long, nearly east and west, ¼ mile wide and, at its highest point, 228 feet high; it is surrounded by rocky bluffs and is entirely barren.

Gallo and Gallina are two small islands lying a short distance southeastward of Ballenas Island. Between them and the western shore of Espiritu Santo is Port Ballena, an anchorage partially protected by the islands, which is frequented by coasters.

Prieta Point, 2 miles southeastward of Gallina Island, is a sharp bluff point of dark color, descending in several steps from the hills behind it.

San Gabriel Bay, eastward of Prieta Point, is of considerable extent, but with very shoal water except in its outer portion; vessels anchoring here should keep outside of the 5-fathom curve.

Dispensa Point, the southwestern extremity of Espiritu Santo Island, is a rocky bluff of moderate elevation; $\frac{1}{3}$ mile to the northward is a conspicuous red mound, 213 feet high, composed of lumps of lava.

Between Dispensa and Lupona Points the shore recedes and forms a bight, about $\frac{1}{3}$ mile deep, off which shoal water extends $\frac{3}{4}$ mile from the land, at which distance the depth is 3 fathoms.

San Lorenzo Channel, which separates Espiritu Santo Island from the mainland to the southward, is 3½ miles wide at the narrowest part, but some dangerous rocks and shoals in it render great caution necessary in its navigation. The main channel, between Scout Shoal and San Lorenzo Reef, is a mile wide and carries in mid-channel from 7 to 8 fathoms.

Scout Shoal, lying 1.1 miles 330°, from Arranca Cabello Point, is nearly oval in form, ½ mile in length, and has in the shoalest part 2 fathoms of water; the botton is rocky, being composed chiefly of loose stones. Between this shoal and the 2-fathom shoal off Arranca Cabello Point is a passage ½ mile wide, with 3½ fathoms of water. A black conical buoy marks the northern edge of this shoal.

San Lorenzo Reef is a rocky ledge lying $1\frac{1}{4}$ miles northwestward from Scout Shoal; its northwestern limit is about the same distance, 145° , from Lupona Point. It is 800 yards in length, in a general southeasterly and northwesterly direction, by 500 yards in width, with a least depth of $1\frac{1}{2}$ fathoms. It is marked by a red spar buoy. Between the reef and Lupona Point is a clear passage, 1 mile wide, through which 4 fathoms may be carried.

Suwanee Rocks lie about ½ mile northeastward from San Lorenzo Reef. The patch is small in extent, with a least depth of 4 feet and is marked by a red conical buoy; around it, close-to, are 5 and 6 fathoms.

Caution.—The buoys marking Scout Shoal, San Lorenzo Reef, and Suwanee Rocks can not be depended upon.

Directions.—In entering La Paz Bay by the main San Lorenzo Channel, coming from the eastward, a course 271° with the north point of Ceralbo Island directly astern, should lead midway between the shoals in 7 to 8 fathoms. In order to avoid Scout Shoal, care must be observed that Dispensa Point bears nothing to the northward of 308° before the range of Diablo Point with the point next to the northward of it is passed; and, to avoid San Lorenzo Reef and Suwanee Rocks, that after this range is passed Dispensa Point shall bear nothing to the westward of 300°. When Lobos Rock (12 feet high) is open off Diablo Point, or the point bears 195°, all dangers will have been passed and a course may be shaped for any part of La Paz Bay.

If coming from Ceralbo Channel, after passing Coyote Point at a distance of about 1 mile, steer for Dispensa Point on the bearing 291° until Arranca Cabello Point bears 218°; then steer 271° to pass midway between the shoals, using safety bearings or ranges as above.

Danger angle.—The use of the danger angle affords the best and safest means of keeping clear of the shoals, being independent of compass errors and roughness of bearings. With the angle of 93° on the sextant, steer so that this shall be the angle between Coyote and San Lorenzo Points, or between the right and left tangents of the shore to the southward, taking care not to get above 99° or below 88°. This will lead through the channel between the shoals.

It is well to plot the danger circles on the chart as general guides.

North Channel.—To enter by the north channel, which lies between Lupona Point, on the north, and San Lorenzo Reef and

Suwanee Rocks, on the south, steer 267°, on the range of Dispensa and Lupona Points until Bonanza and Lobos Points are in range, then haul to the southward on this range, steering 201°, which will lead about 1 mile clear of Diablo Point.

If too dark or too hazy to see the ranges or the land until close-to, steer to make Bonanza Point, and then follow along the shore to the southward, at $\frac{1}{4}$ to $\frac{1}{2}$ mile, until Lupona Point bears 270°, distant not over $\frac{3}{4}$ mile, then steer 201°, as above.

From La Paz Bay, to pass out by the main channel, bring Bonanza and Lobos Points in range and steer 21° on that range until the west end of Ballena Island is in range with Dispensa Point, then steer 91° between the shoals, allowing for the turn, for the north end of Ceralbo Island, using the safety ranges, or much preferably the danger angle, as given for entering.

To pass out by the north channel, continue on the range of Bonanza and Lobos Points, 21°, until Lupona Point bears 270°, or is in range with Red Mound, 213 feet high, or Dispensa Point, then steer 90° until the shoals have been passed, as indicated by the bearing of Lobos Point.

Of the two passages the northern seems the safer for vessels of not over 21 feet draft, especially at night or in thick weather, as the west shore line of Espiritu Santo Island is clean within 1 mile, and makes an excellent guide for avoiding the rocks and shoals to the southward.

The channel south of Scout Shoal, is only 700 yards wide, and should not be attempted except in case of necessity, or after a careful study of courses and bearings.

Caution.—The buoys for San Lorenzo Channel are not to be depended upon; the use of safety ranges or the danger angle is therefore essential to safety.

Winds in the channel and in La Paz Bay are regular during the greater part of the year; from November to May the northwesterly winds, which blow from 9 a. m. to 4 p. m., are succeeded toward evening by southerly winds which last all night; during the remainder of the year, southeast and southwest winds prevail. Calms are frequent in the spring and summer months.

Tides.—High water, full and change, in San Lorenzo Channel, is at 8h. 22m.; springs rise 41 feet.

The tidal streams run with considerable velocity, sometimes $2\frac{1}{2}$ knots an hour, and from October to February at a velocity of 3 knots.

La Paz Bay, into which San Lorenzo Channel leads, is nearly 40 miles long north and south and from 16 to 20 miles wide, with deep water throughout its extent and no known hidden dangers. The town of La Paz is situated in its southeastern part.

Diablo Point lies about 1½ miles southwestward of San Lorenzo Point and is a sharp rocky bluff, with deep water close-to.

Port Ballandra, between Diablo and San Lorenzo Points, is a small cove 1,200 yards wide at the entrance and extending 1½ miles within the points. At the entrance there are 12 fathoms water, and about 700 yards inside is the 3-fathom curve, within which it is full of rocks and shoals.

Lobos Rock lies $1\frac{1}{8}$ miles 197° from Diablo Point. It has a broken surface and is 12 feet high. The water on the western side is deep close-to; a small patch, with $2\frac{3}{8}$ fathoms water, lies close to the eastern side; between the rock and the shore to the eastward is a passage $\frac{1}{2}$ mile wide.

There is a small cove, or indentation of the shore, eastward of the rock, with from 2 to 5 fathoms of water, which would afford good shelter for small light-draft vessels.

Lobos or La Gaviota Island, $\frac{3}{4}$ mile southeastward of Lobos Rock and $\frac{1}{4}$ mile from the mainland, is about $\frac{1}{4}$ mile long and 90 feet high. A light deposit of guano gives it a whitish color, by which it may be easily recognized. On its western side the water is deep close-to.

San Juan Nepomezeino Island lies about 3½ miles southward of San Lorenzo Point and is 1¾ miles long, north and south, about 600 yards wide, and 80 feet high. The western shore of the island is a steep bluff, with 5 fathoms of water to within 200 yards of the land. A gravel beach extends around the southern end of the island, and the 5-fathom curve makes off about ½ mile to the southwestward. Near the southeast point is a rocky bluff, and behind it a small hill 65 feet high, its western side sloping to a salt lagoon about 500 yards long by 300 yards wide, which yields by the natural evaporation large quantities of salt. The eastern side of the island is mostly a shelving sand and gravel beach.

Pichilinque Harbor lies between San Juan Nepomezeino Island and the mainland to the eastward of it. Although small, it is one of the best harbors on the coast, being well protected on all sides. It is a very convenient anchorage for vessels of too great draft to enter La Paz Harbor, with which communication can be easily kept up by means of boats, the wind being fair to go during the greater part of the day and to return toward evening and during the night.

The entrance is from the southward, the northern end of the island being connected with the mainland by a shoal, over which there is only 3 feet of water. Directions for entering the harbor are unnecessary as the passage is clear, with 3 fathoms of water within 50 yards of the shore on either side, deepening to 4½ and 5½ fathoms midway between heads.

In rounding the southern end of the island, it should be given a sufficient berth to clear the tail of shoal water extending from the southwestern shore.

The Pearl Shell Co., now owning the island, and working the salt lagoon, has a considerable plant, with a pier about 120 feet long, 30 yards northwest of the new coal pier.

Naval coal depot.—The United States Government has a naval coal depot in Pichilinque Harbor, at the southeastern end of the island.

Supplies.—Water of fair quality may be obtained in small quantities from a well situated in a valley leading from the eastern shore of the harbor. No provisions are obtainable.

Tides.—The corrected establishment of the port is 9h. 38m.; springs rise 5.3 feet.

Position.—The observation spot at the southeastern end of the island is in latitude 24° 15′ 36″.47 N., longitude 110° 19′ 35″.61 W.

False Bay, just south of the eastern entrance point of Pichilinque Harbor, is about $\frac{3}{4}$ mile in extent, northeast and southwest, and has in its outer part 5 and 6 fathoms of water.

Colorado Point, the first point south of the entrance to Pichilinque Harbor, distant \(\frac{2}{4}\) mile, is a bold rocky bluff of reddish color, about 50 feet high, with shoal water extending from 100 to 200 yards from it. The deep bight southward of the point is full of shoals.

Prieta Point, about 13 miles southward of Colorado Point and just north of the entrance to La Paz Channel, is a sharp vertical gray bluff, 32 feet high, with gradually rising land behind it. Near the point are some outlying rocks, and from it shoal water, with rocky bottom, extends about 1 mile southwestward. Three miles 70° from the point is a hill, 1,553 feet high, the highest in the vicinity.

When waiting to enter the channel, or if intending to remain outside, vessels may anchor close under Prieta Point in from 7 to 10 fathoms.

Prieta Point Light.—Group occulting, visible 10 miles, is exhibited at a height of 56 feet from a white wooden tower on Prieta Point.

La Paz Channel leads between extensive shoals and the mainland; it is about 3½ miles long from Prieta Point to La Paz and shows the least depth of 3½ fathoms with a rise and fall of about 4 feet, but this depth can not be depended upon. Vessels of 19 feet draft may pass through the channel at any stage of the tide. The channel is narrow, with steep banks on either side, the water in some places shoaling from 3 fathoms to 3 or 4 feet within a distance of 20 yards. The deep water of the channel and the projecting points of the shoals on either side can be readily distinguished from aloft. The channel is fully buoyed and no pilot is needed.

There is a channel, with 9 feet least water, much used by small coasters, about a miles southward of Prieta Point. To pass through it bring Caymancito Rock, on the eastern side of the channel, to bear 129° and steer for it on that bearing.

Buoyage.—La Paz Channel is well marked by numerous buoys, red on the starboard hand entering and black on the port as in the United States. All buoys were shifted to conform to the best water in 1917.

La Paz Harbor is formed by a low, sandy, bush-covered peninsula, known as El Mogote, about 5 miles long east and west, and $1\frac{1}{2}$ miles wide in its widest part, from the eastern end of which a shoal with only 3 to 4 feet of water extends to the northward nearly to Prieta Point, forming the western side of La Paz Channel. This shoal protects the harbor from the seas caused by the northwesterly winds. Between the town and the shore of El Motote, the harbor is from $\frac{1}{2}$ to $\frac{3}{4}$ mile wide, but is nearly filled with shoals through which winds a continuation of the channel, with depths of from 3 to 4 fathoms.

After passing La Paz the channel curves to the westward and enters a large lagoon that lies in a low almost level plain, covered with a thick grownth of trees, bushes, and cactus. The water is shoal over the greater part of this lagoon, but a channel with from 2 to 3 fathoms leads to its northwestern limit.

Boat passage.—Beginning at deep water about $\frac{3}{4}$ mile northwestward of the eastern point of El Mogote, a boat passage crosses the shoal in $1\frac{1}{4}$ fathoms at low tide, and passing close to the point enters the harbor opposite the town. The passage is very convenient for vessels anchored north of El Mogote, as it affords a short cut for boats to and from the town.

La Paz, with a population in 1910 of 5,400, is the largest and most important town of Lower California, and is the seat of government for the southern district, which extends from El Rosario, in latitude 28°, to Cape San Lucas. The business center of the town is on low flat ground in the mouth of an arroyo, but the cathedral, the government house, the barracks, and many of the fine residences are situated on a low table-land behind the town. There is a small police force and a regular garrison of 100 men.

The town has a very cheerful appearance, many of the streets being lined with shade trees, and nearly every house having a court or garden filled with tropical plants. The houses are in general of adobe, one story high, with flat roofs. The water supply is obtained from wells and cisterns.

The United States is represented by a consul and a vice consul.

Anchorage.—The best berth off the town is from 200 to 300 yards westward of the wharf in about $3\frac{1}{2}$ fathoms, sand. Vessels drawing less than 12 feet can lie at the end of the wharf. A concrete iron

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wharf is being built, at the outer end of which vessels drawing 17 feet may lie.

Tides.—The corrected establishment of the port is 9h. 40m.; springs rise 4½ feet. The tidal streams at the anchorage run at the rate of about 2 knots. The tides are much affected by the winds, and for this reason the Tide Tables can not be relied upon.

Pilotage.—There is a regular Government pilot, who, while performing this duty, has the rank of a captain in the Mexican Navy.

Lights.—On the head of the mole at La Paz is shown a fixed green light.

On the beach near the customhouse a fixed red light visible 6 miles is shown, 32 feet above high water, from a tubular iron structure painted red. See Light List.

Supplies.—Very little in the way of supplies is to be had. Beef in moderate quantities, fish, and a few vegetables can be obtained by giving two or three days' notice. Vessels should not depend on La Paz for supplies. There is no coal.

Water of an inferior quality and in moderate quantities may be obtained in water boats. It is pumped from wells in and back of the town, but it is stated to be somewhat brackish and not good.

Commerce.—Vessels of the United States comprise most of the foreign shipping. A number of small vessels under the Mexican flag, engaged in whaling, pearl fishing, and the guano trade, make La Paz their port of call. The exports are silver ores, bullion, hides, orchilla, pearl shell, and guano, and are of an average yearly value of about half a million dollars, all for San Francisco. The imports are cotton goods, machinery, iron, and provisions, almost all from the United States. An extensive trade is carried on between La Paz and the settlements of the interior, and with those of both coasts of the gulf.

Climate.—The climate is hot and dry, but healthy, though the place was visited by yellow fever in 1883, when it spread over the Pacific coast. The thermometer ranges in winter from 50° in the morning to 74° in the afternoon; from June to October, from 80° to 100°; the summer, which is the rainy season, is the most unhealthy. During the months of September, October, and November hurricanes sometimes occur. The average rainfall does not exceed 2 inches.

Quarantine is strictly enforced by a sanitary commission appointed by the Federal Government; vessels are boarded by a health officer before the customs or any other port officials are allowed to board, and before any communication can be had with the town. The health officer will visit vessels anchored off Prieta Point when notified that they desire communication with the shore. This quarantine district includes Pichilinque. A large and commodious hospital, with two official surgeons in attendance, is open to the public and the marine service.

Communications.—Three regular lines of mail steamers call at La Paz. The Pacific Coast Steamship Company's steamer, leaving San Francisco the 7th of each month, makes monthly round trips between that city and Guaymas, calling, both going and returning, at Ensenada, Magdalena Bay, San José del Cabo, Mazatlan, Altata, La Paz, and Santa Rosalía; the steamer leaves La Paz on the 15th of the month for Guaymas, and on the 18th for San Francisco. A steamer of the Luis Martinez Line makes three round trips a month between Guaymas and La Paz, calling at Santa Rosalía, Mulegé, and Loreto; the steamer leaves Guaymas on the 1st, 11th, and 21st of the month, and touches at La Paz on the 5th, 15th, and 25th. A steamer of the Trasporte Maritimo Line makes two round trips a month between San Blas and Guaymas, calling each way at Mazatlan, San José del Cabo, La Paz, Loreto, and Santa Rosalía. Weekly overland mails are sent to and received from San José del Cabo and intermediate places. There is no telegraphic communication.

Coast.—From the eastern end of El Mogote, for a distance of about 8 miles, the southern shore of the bay trends nearly west, and is low and sandy, covered at a short distance from the beach with shrubs and bushes; for 6 miles farther, sand hills varying in height from 15 to 75 feet are found, the coast line curving gradually to the northward. Throughout this distance a series of sand shoals extends off the coast nearly a mile, the soundings over them varying from $\frac{3}{4}$ fathom to 3 fathoms.

At 14½ miles from the eastern point of El Mogote, the character of the coast changes, and it assumes a more northerly direction. From this point it presents a long unbroken range of table-land from 500 to 1,000 feet high, ending in almost perpendicular cliffs from 50 to 100 feet high, interspersed with shingle beaches. At 5½ miles south of Coyote Point, a perpendicular white rocky bluff 150 feet high, there is a small ranch called San Juan, behind a low shingle beach. A conspicuous dark-colored peak, 1,421 feet high, rises just behind the ranch, 1½ miles to the westward. The soundings off this part of the coast show depths of 15 to 20 fathoms at 2 miles from the shore.

North of Coyote Point the coast recedes considerably, the bluffs gradually decrease in height, and their place is taken by sand beaches backed by sand hills. A short distance inland a range of table mountains, broken by deep canyons, rise abruptly to heights of from 1,500 to 2,000 feet. As Mechudo Head is approached, the main range of table mountains draws nearer the coast, and perpendicular bluffs from 150 to 200 feet high replace the sand beaches.

Mechudo Head, the northern limit of La Paz Bay, is a bold, perpendicular, stratified cliff about 300 feet high, surmounted by a dome-shaped hill 750 feet high. At 3½ miles nearly due west from

the headland is Mount Mechudo, 3,672 feet high, the only prominent peak in this range of mountains; is visible upward of 50 miles, and, with the prominent headland, makes an excellent landmark in the navigation of the gulf.

San Josef Channel, between San Josef Island and the coast of Lower California, is 20 miles long with an average width of 4 miles and a least width, near the northern entrance, of 2½ miles. This channel is much used by sailing vessels when beating up the gulf, as, by working through it, they avoid the heavy sea outside, and can take advantage of the strong tides that set through it. In bad weather anchorage can be found in the bights and coves on either side. At night or in thick weather it is recommended to keep well over toward the western shore, where there are no outlying dangers.

The tidal streams set through the channel with a velocity of from 1 to 3 knots.

The coast north of Mechudo Head retains its character of high, perpendicular cliffs for about 1½ miles, when the cliffs are replaced by a sand beach which, broken by only one short bluff, extends northward 4½ miles to within 1½ miles of San Evaristo Point.

Two miles southward of San Evaristo Point a low sandy point makes out a short distance, immediately south of which is good anchorage in 5 or 6 fathoms, ½ mile from the beach. There is another anchorage immediately south of San Evaristo Point, where a sudden change in the direction of the cost forms a cove about ¼ mile deep, with a sandy beach at its head. Between this sand beach and the long stretch of sand beach (4½ miles) before mentioned there is a mile of rocky bluffs from 20 to 50 feet high.

San Evaristo Point is a rocky headland, 130 feet high, projecting if mile from the general coast line. There is a ranch near the beach of the hight on the northern side of the headland.

From San Evaristo Point to Nopolo Point, a distance of 63 miles, the land is high and precipitous, with occasional short stretches of sand beach and deep water close to the shore. At 14 miles southward of Nopolo Point is a slight indentation in the coast line and an estero, where it is said fresh water may be procured.

Nopolo Point is a rocky cliff with a rugged peak, 1,578 feet high, just behind it. A succession of rocky bluffs from 400 to 500 feet high extend about 3½ miles northwestward from the point.

San Francisco Island, on the east side of the southern entrance to San Josef Channel and 4½ miles from Mechudo Head, is of irregular shape, 689 feet high, with an area of about 1½ square miles. Its shores consist for the most part of rocky bluffs, varying in height from 20 to 150 feet, with intervening sand beaches. The southeast end of the island is a rocky head, 300 feet high, connected with the main body by a low sandy neck. Off the northern and the southern

point are numerous outlying rocks, and in a bight on the eastern side is a rock 4 feet high, 200 yards from the shore.

Anchorage may be found in from 5 to 10 fathoms off a sand beach that lies just west of the southeastern head.

Sounding around the island show from 3 to 9 fathoms close-to; except on the northwest side, where it is shoal, with $2\frac{1}{2}$ fathoms at $\frac{1}{4}$ mile from the shore.

Channel.—Between the islands of San Josef and San Francisco is a channel 1½ miles wide, with from 4 to 6 fathoms water; but a group of rocks in the middle, called Coyote Rocks, and another group just beyond the western limit, called Seal Rocks, make it very dangerous, and its passage should never be attempted unless in an emergency.

Coyote Rocks, the highest of which is 40 feet high, lie $\frac{3}{4}$ mile northwestward of the northern point of San Francisco Island, the channel between the island and the rocks having from 3 to 5 fathoms water. The channel between the rocks and San Josef is less than $\frac{1}{4}$ mile wide, with from 6 to 7 fathoms water; north of the main group are some outlying sunken rocks. If obliged to pass between San Josef and San Francisco Island it is safer to keep the shore of San Josef close aboard.

Seal Rocks lie 13 miles west of the north point of San Francisco Island, and consist of two flat rocks about 5 feet above water, with several outlying ones under water. The soundings between the rocks and the point, as well as between them and the Coyote Rocks, show a depth of 11 fathoms.

San Josef Island is of volcanic origin, 16½ miles long and from 2 to 6 miles wide, being narrowest at the northern end, which terminates in a sharp point. The highest peak, near the middle of the island, is 2,077 feet high, and covered in most parts with vegetation, especially on the high land in the numerous deep arroyos of its northeastern portion.

From the southeastern point of the island, the south coast, which is mostly a sand beach with hills behind it from 100 to 500 feet high, trends to the westward for 3½ miles to the southwestern extremity, which is a low sand spit making out 1½ miles from the body of the island. A lagoon of considerable size extends to within ½ mile of the point, and has an opening to the sea on the northern side of the sand spit.

From the southwestern point, which may be approached close to, there being 19 fathoms of water within 200 yards of it, the coast turns sharply northeastward for about 1½ miles, to the mouth of the San Josef River; thence it assumes a northwesterly direction.

Amortajada Bay, an indentation of the coast line between the southwestern point of the island and Salinas Point, is about 4 miles

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wide between the two points and 1½ miles deep within them. In its southern part there is good anchorage in 7 or 8 fathoms water, protected from all winds, and especially from the dreaded Cordonazos or southeasterly gales.

Fresh water may be obtained here. The smelting works on the shore of the bay are abandoned.

Cayo Islet, lying 1,600 yards 310° from the southwestern extremity of San Josef, protects considerably the anchorage in Amortajada Bay from the northwesterly winds. The islet is about ¼ mile long and 100 yards wide, with a height of 40 feet at its southern end, and from 10 to 15 feet at the northern end, and a break near the middle over which the sea washes at high water. A reef projects from the northern end about ¼ mile.

Salinas Point is sandy, with a steep sand hill 50 feet high immediately behind it, and lies nearly due east from San Evaristo Point, the channel between them being 3 miles wide. Near the point are two lagoons, which produce large quantities of salt, the land behind them rising in broken ridges to a height of 1,830 feet. For 3½ miles northward of the point the coast is a low sand beach, at the northern end of which is a ranch; nearly east of this ranch the island attains its greatest elevation, 2,077 feet, in a conspicuous knob of the main ridge. For 2 miles north of the ranch, steep hills rise immediately from the water; winding between them, its mouth about a mile north of the ranch, is a deep arroyo which extends halfway across the island. At 2 miles from the ranch the coast again becomes a low sand beach, which, broken by a single bluff, extends to a point opposite Nopolo Point; this is the narrowest part of the channel, here only 2½ miles wide.

Anchorage.—In the bight southward of the above-mentioned point, good anchorage may be found in from 6 to 12 fathoms, 200 to 300 yards from the shore. The land behind the coast, which for 3 or 4 miles to the southward has been lower, begins here to rise again. Anchorage may also be had north of the point.

Just north of the point is a lagoon with a shallow opening to the sea; thence to the north point of the island, a distance of about 4 miles, the coast trends north, and is an unbroken line of steep rocky bluffs of dark color. A reef of rocks, some of them above water, projects from the northern end of the island about ½ mile. At 1¾ miles from the northern extremity, a sharp peak, 1,382 feet high, rises steeply from both shores.

No detailed examination of the eastern side of San Josef Island has been made. It is in general a succession of high rocky bluffs, with some intervening sand beaches, and is said to be clear of dangers, unless close in to the land.

Red Point, 9 miles from the northern end of the island, is the first prominent point on the east side; the intermediate coast recedes somewhat.

Southeast Point is 9 miles southward from Red Point; there are several outlying rocks off the point, and a hill 400 feet high rises abruptly just behind it. For 5 miles northward from the point the coast is a series of inaccessible bluffs from 50 to 500 feet high.

Soundings along the eastern side of the island show depths of over 50 fathoms a short distance from the shore.

Las Animas are a group of rocky islets not over $\frac{1}{4}$ mile in extent, including the several outlying rocks; the largest and highest is about 90 feet high. They lie $10\frac{1}{2}$ miles 87° from the north point of San Josef and between them and the island is a deep clear channel.

Coast.—Between Nopolo Point and San Telmo Point the coast recedes considerably and is a succession of rocky bluffs, with intermediate sand beaches and deep ravines. A range of mountains about 2,500 feet high rises just behind the coast, and off the coast lie several prominent islands and rocks.

Two miles northwestward of Nopolo Point, a conspicuous broken rocky cliff from 300 to 500 feet high, known as Los Burros, projects slightly from the general coast line. Deep water extends close up to the cliff.

Dolores Point, 3 miles farther up the coast, is similar to Los Burros; northward of the point a slight indentation in the coast line forms Dolores Bay. Near the point is a ranch, and stretching away toward the mountains a fertile slope, green with vegetation. The point and bay take their name from the old mission, La Virgen de los Dolores, situated a few miles inland. A conspicuous red-colored rocky bluff marks the northwestern limit of Dolores Bay.

Habana Island, a barren guano-covered rock about 1,000 yards long, east and west, 500 yards wide, and 90 feet high, lies 2½ miles north of the red bluff above mentioned and 8½ miles 280° from the north point of San Josef; between the islet and the nearest point of the mainland is a channel a little over a mile wide, with from 10 to 17 fathoms of water. West of Habana Island is a small indentation in the coast line with a gravel beach, behind which is an open valley.

Moreno Rocks lie $5\frac{1}{2}$ miles 330° from Habana Island and $\frac{1}{2}$ mile from the nearest shore. Between them and the mainland the water is shoal. The highest and largest of the rocks is 40 feet high, and from it a reef of rocks partly above water projects about $\frac{1}{4}$ mile in a southeasterly direction. On the mainland, about 2 miles southward of the rocks, is a lagoon.

The coast in this vicinity is a pebble beach, with occasional bluffs, from 10 to 25 feet high, of a yellowish and reddish color. A promi-

nent mountain 2,534 feet high, rising 4½ miles from the coast, makes a good landmark in this part of the gulf.

Black Rock, 55 feet high, is 2½ miles northward of the Moreno Rocks and about a mile from the shore of the mainland. The passage between the rock and the mainland is apparently safe for small vessels.

San Carlos Bay.—The coast north of Black Rock recedes somewhat, forming the open bay of San Carlos, which affords good anchorage in from 5 to 7 fathoms of water. At the head of the bay is the narrow entrance to a lagoon, with a sand beach on either side.

San Telmo Point is a sharp rugged point 30 feet high, projecting $\frac{1}{4}$ mile from the coast, with numerous outlying rocks off it, close-to; the bluffs on either side are of a reddish color. Nearly west from the point, $6\frac{1}{2}$ miles, is a conspicuous table mountain 2,818 feet high.

San Diego Island, the center of which lies 5½ miles 6° from the north point of San Josef, is nearly a mile long, and its highest point is 722 feet high. A reef of rocks, many of them above water, over which the sea generally breaks, makes off ¾ mile southwestward from the southwestern point, ending in a small rock awash, close to which 4 and 5 fathoms were obtained. Nearly ½ mile farther, in the same general direction, 3½ fathoms were found; thence the soundings increased suddenly, 140 fathoms being found within a mile.

Passage.—There is an apparently clear passage nearly 4 miles wide between San Diego and San Josef Islands, with from 30 to 44 fathoms water midway; but it should be used with caution, not having been thoroughly examined.

Santa Cruz is a high, barren, rocky island, $3\frac{3}{4}$ miles long, about $1\frac{1}{4}$ miles wide and 1,500 feet high; the eastern face is inaccessible, consisting of high bold bluffs from 300 to 1,000 feet high; the northeast part terminates in a sharp point; the western face slopes from the shore at an angle of 45° . The only landing place is at the southwest end, where there is a short stretch of gravel beach.

Channel.—Between Santa Cruz and San Diego is a channel 3½ miles wide, apparently free from all dangers. No bottom was found at 100 fathoms midway between the two islands, and a depth of 195 fathoms, sand bottom, 1½ miles from Santa Cruz.

Coast.—The coast between San Telmo and San Marcial Points, a distance of 14 miles, is nearly straight; it is in general rocky, with bluffs from 75 to 350 feet high and a few short stretches of sand beach. The water is deep close-to, from 10 to more than 30 fathoms being found within ½ mile of the beach. High mountains rise immediately behind the coast.

Santa Marta Bay is formed by a slight indentation in the coast line between San Marcial Point and a steep rocky bluff, 13 miles south

of it; in good weather vessels may find anchorage here in from 10 to 12 fathoms, within $\frac{1}{2}$ mile of the small sand beach at the head of the bay. The land behind the bay is extremely mountainous.

Reef.—Southeastward from San Marcial Point, the innermost rock ½ mile distant from it, a dangerous reef of rocks awash, on which the sea breaks in all weathers, extends about ½ mile in a general east-southeasterly and west-northwesterly direction, with deep water close-to. Between the reef and the point 9 and 10 fathoms were found, and ½ mile outside of the reef 30 fathoms.

San Marcial Point is a moderately high rocky cliff, surmounted by a peak 1,131 feet high. The observation spot, on the shore 1 mile south of the point, is in latitude 25° 29′ 23″ .1 N., longitude 111° 1′ 43″ .1 W.

San Marcial Rock, 1½ miles, 16°, from the point, is of small extent and 25 feet high, with numerous smaller rocks surrounding it, and a small rock awash lying about ¼ mile north-northwestward from it.

Between San Marcial Rock and the nearest point of the mainland is a passage 3 mile wide, with from 4 to 8 fathoms water.

Agua Verde Bay.—From San Marcial Point the coast trends nearly north ½ mile, and then turns abruptly westward for a mile and a half to the small bay of Agua Verde, where there is good anchorage in ordinary weather, and fresh water may be obtained from a ranch near the beach. The best landing place is in the eastern part of the bay, near a bluff point off the northeast side of which, closs-to, are one or two rocks awash at low water.

Pasquel Point, at the western limit of Agua Verde Bay, is a rocky bluff with a large white rock (Solitaria) lying 200 yards northeastward of it. A mile westward of Pasquel Point is another rocky bluff point, off which, to the northwestward, are two rocks above water. West of the latter point is a stretch of sand beach about 2 miles long, on which are some ranches and an arroyo; beyond the arroyo the coast line assumes a northwesterly direction.

San Cosme Point is a rocky cliff, rising abruptly to a hill 225 feet high. About a mile northward of the point is a group of rocks, the westernmost and largest of which, San Cosme Rock, is 75 feet high; a third of a mile eastward of this is San Damien Rock, 45 feet high, and at about one-third of the distance between the latter and the point are some low rocks from 2 to 4 feet above water, with some rocks awash near them. The soundings obtained between these rocks and the shore showed no bottom at 10 fathoms. Four miles southwestward of San Cosme Point are conspicuous sharp twin peaks 3,808 feet high, forming an excellent landmark.

Coast.—From San Cosme Point to Candeleros Point, a distance of 10³ miles, the coast trends about north-northwestward, and is a

succession of bluffs and sand beaches; the mountains rise immediately behind the coast to a height of 2,000 feet.

White Rock, 127 feet high and surrounded by a number of smaller rocks, both above and below water, lies 4 miles 139° from Candeleros Point and about 2 miles from the nearest shore. There is a good depth of water on all sides of these rocks, at a short distance from them.

Monserrate, like all the other islands in this vicinity, is of volcanic origin and perfectly barren. It is 4 miles long in a north and south direction, and from 1 to 2 miles wide; its highest peak is 734 feet high. The south point of the island bears 48° from San Cosme Point, the nearest point of the mainland, the channel between them being 7 miles wide, with from 50 to 80 fathoms of water. The southern and eastern shores of the island are a succession of bold rocky bluffs, off which in several places rocky ledges, under water, project from \(\frac{1}{8}\) to \(\frac{1}{4}\) mile from shore. Off the north and northeast points are some outlying rocks, and on the north side is a small bight with a short strip of sand beach near the northwestern point; the western side of the island has a low rocky shore with shelving points.

Las Galeras are two rocky islets lying $1\frac{3}{4}$ miles northward of Monserrate Island; the eastern and larger islet is 70 feet high; a reef of rocks projects from it to the southeastward nearly $\frac{1}{2}$ mile; the western islet is about 40 feet high; between the two is a passage about $\frac{1}{8}$ mile wide full of rocky ledges and with varying depths of water. The least water found between Las Galeras and the north end of Monserrate was 7 fathoms.

At 1½ miles north of Las Galeras is a dangerous rock, only about a foot above high water; the soundings between the rocks and Las Galeras show from 11 to 22 fathoms.

Santa Catalina Island, 113 miles eastward of Monserrate Island, is 7½ miles long north and south, about 2 miles wide, and its highest peak 1,543 feet high. No detailed examination has been made of this island, but its shores are said to be abrupt, with deep water close-to. There is reported to be a landing place on a sandy beach at its southern end. No soundings were obtained in the channel between Santa Catalina and Monserrate.

Candeleros Point is a prominent steep bluff about 50 feet high, the land behind it rising abruptly. The water is deep close up to the point, 95 fathoms, muddy bottom being found within ½ mile of it.

Los Candeleros are three pinnacle-shaped rocks, lying northward of the point and between it and Danzante Island. The rock nearest the point, ½ miles distant, is about 100 feet high; the second, 0.3 mile northward of the first, is 80 feet high; the third, ¾ mile northwest-

ward of the second and about the same distance from the south point of Danzante Island, is 40 feet high and has some outlying rocks to the southeastward.

Caution.—The soundings between Candeleros Point and Danzante Island vary from 12 to 26 fathoms; the passage should be used with great caution, as it is thought there may be other rocks in it not yet discovered.

Coast.—From Candeleros Point to Coyote Point the coast makes a sweep to the westward, forming an open bay in which are several outlying rocks. The soundings along the shore of the bay are irregular; in some places only $2\frac{1}{2}$ fathoms were found at $\frac{1}{2}$ mile from the shore. Behind the coast the land rises gradually to high mountains, the southern portion of the Sierra de la Giganta.

Rocks.—Three and a half miles 309° from Candeleros Point is a group of rocks, varying in height from 15 to 40 feet, the outermost rock a mile offshore. Between the rocks is a passage 1½ miles wide, with about 16 fathoms water, apparently free from dangers; between the group and the mainland is foul ground, with from 2 to 3 fathoms water.

Water.—About 2½ miles southward of Coyote Point is a strip of sand beach, behind which is a fertile green slope with a ranch at its foot. An abundance of good fresh water may be obtained here from wells 10 to 15 feet deep.

Coyote Point is a steep bluff headland, 75 feet high, the eastern extremity of a pear-shaped peninsula about 13 miles long, and 3 mile wide at its southern end, on which is a hill 350 feet high. The northern end of the peninsula is joined to the mainland by a narrow neck on which there are some low sand hills.

Puerto Escondido, or hidden port, is perfectly landlocked and a secure harbor for small vessels, in all weathers; the entrance, which is only about 75 feet wide, lies between the southern end of the peninsula and the mainland. Only 9 feet of water will be found on the bar at high tide, the water deepening inside to 4 and 7 fathoms; the harbor is of small extent, being about a mile long north and south, and 4 mile wide.

Danzante, a barren island lying a short distance off the coast, between Candeleros and Coyote Points, its southern end $2\frac{1}{2}$ miles from Candeleros Point and $1\frac{1}{2}$ miles from the nearest point of the mainland, is $3\frac{1}{2}$ miles long, $\frac{7}{8}$ mile wide in its widest part, and its highest peak 450 feet high. On the southwest side is a strip of sand beach off which anchorage may be found; with this exception, the shores of the island consist of bold rocky bluffs, from 25 to 75 feet high, with deep water close-to. Half a mile from the northern end a shallow channel, full of rocks above and below water, completely divides the island. Off the southern end is a detached

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pinnacle rock 25 feet high. Between Danzante and Carmen Islands is a channel 1½ to 2¼ miles wide, free from all dangers, much used by vessels from the southward, bound to Loreto. The tidal currents in the channel are very strong.

Chuenque Bay, a small bay $1\frac{3}{4}$ miles northwestward of Coyote Point, affords protection from all winds except northerly ones; on its eastern side is a small island about $\frac{1}{2}$ mile long and 40 feet high. To enter Chuenque Bay, pass north of this island, as the passage south of it is only 600 yards wide and quite shoal.

Nopolo Point is a bold rocky point, 75 feet high, about 5 miles northward of Chuenque Bay. The intermediate coast consists of bluffs from 15 to 75 feet high, and pebble beaches, with deep water close-to, 10 to 15 fathoms being found within 200 yards of the shore, deepening to 120 fathoms at a little more than $\frac{1}{2}$ mile.

Westward of Nopolo Point is a small shallow cove, open to the northward, sometimes used by small vessels.

From Nopolo Point to the anchorage off Loreto, a distance of $5\frac{1}{2}$ miles, the coast is a low sand beach, immediately behind which is a fertile country. A mile and a half south of Loreto is Primera Agua Point, a low sandy point, projecting slightly from the general coast line, off which shoal water (from 1 to 3 fathoms) extends about $\frac{1}{2}$ mile.

Loreto, a straggling village of about 150 inhabitants, is situated at the entrance to a valley, which extends inland to the high mountains of the Sierra de la Giganta, and is the seaport of Comondu, about 27 miles distant, with which it is connected by a road passing over the Sierra de la Giganta; there is also a road to Mulege about 70 miles up the coast. The site was badly chosen, being on the bank of a water course, often dry for several years in succession, but which, after heavy rains in the mountains, may become in two or three hours a raging torrent, sweeping everything before it. From time to time portions of the town have been destroyed or carried off by the stream, so that nearly all that now remains of the old town is the mission church, a large stone structure with an arched roof and a dome at one end, and its adjoining buildings.

Anchorage off the town is good in ordinary weather, in 8 or 9 fathoms, ½ mile from the beach, with the church and Sugarloaf Peak in line. Immediately south of the mouth of the water course, a sand spit with but 2 fathoms of water over it makes off nearly ½ mile from the shore. Tides rise about 4 feet.

The anchorage is open to winds from the north, northeast, and southeast, and when these are strong, so heavy a sea is sent in that it is not safe for a vessel not well found in ground tackle.

¹ There is also a Nopolo Point in the San Jose Channel.

Port Loreto Light.—Fixed white, visible 10 miles, is exhibited at a height of 27 feet from a white iron column, with hut at the base, located east of Loreto village. A conspicuous one-story white house is located about 25 yards southward of the light tower.

Position.—The observation spot on the beach near Loreto is in latitude 26° 00′ 55″ .8 N., longitude 111° 20′ 52″ .7 W.

Supplies.—Fresh beef, vegetables, fruit, wood, and water may be obtained at Loreto. Near the town, to the northward, are several small lagoons, which are a favorite resort of wild ducks at certain seasons of the year.

Remarks.—There is no fruit or vegetable, either tropical or of the Temperate Zone, that can not be cultivated here; cabbages, cotton, lettuce, tobacco, wheat, corn, and onions were all seen growing together in the gardens, while the olive, datepalm, orange, lemon, and banana are met with in abundance, and the vineyards produce a wine unequaled by any of those of Upper California.

Sierra de la Giganta, the highest peak of which is La Giganta, 5,974 feet high, lies behind this part of the coast.

Carmen Island is of volcanic origin and irregular outline, 17 miles long in a general north-northeasterly and south-southwesterly direction and 5½ miles wide in its northern portion; a range of peaks, varying in height from 500 to 1,500 feet, extends through its entire length.

Baja Point, the south end of Carmen Island, is 5 miles distant from Candeleros Point; shoal water, with stony bottom, extends more than 4 mile off the point, which is a low spit of gravel. The land behind the point slopes gradually toward the hills and is covered with grass and low bushes.

Arena Point, 24 miles northwestward of Baja Point, is a low sandy point, behind which are some sharp peaks from 600 to 900 feet high. The coast between the two points is a sand and gravel beach, with a few outlying rocks close to the shore, near Arena Point, and deep water a short distance off the point; on the beach near the point are some huts.

Marquez Bay is a small bay 3 miles northward of Arena Point, the intermediate coast consisting of steep rocky bluffs and deep ravines; at its head is a short sand beach, near which are some huts. North of Marquez Bay the coast is generally steep and rocky, with moderately deep water close-to. Off the point which forms the northern limit of the bay are a few outlying rocks a short distance from the shore.

Puerto Ballandra, a small bay 8½ miles northward of Marquez Bay, is about 800 yards in extent each way, with a depth in most parts of from 5 to 5½ fathoms; the entrance, scarcely 600 yards wide, is

between high headlands. A small lagoon lies just behind the sand beach at the head of the bay.

Cholla Islet.—A mile and three-quarters northward of Puerto Ballandra is a bluff point (the northwest end of the island), ½ mile off which is a small low sand island, about ½ mile long and 20 feet high, known as Cholla Islet; off its northwestern end are some outlying rocks.

Oto Bay.—From the northwest point of the island the coast line turns sharply to the eastward for about 1½ miles, and then curves again to the northward, forming an open bay in which vessels may anchor and find shelter from southerly winds. At the head of the bay are a few deserted huts near an arroyo.

Tintorera Point, $2\frac{3}{4}$ miles from the northwest point of the island, is a steep bluff about 80 feet high, off which are some outlying rocks:

About 14 miles eastward of Tintorera Point is Puerto de la Lancha, a small open bay, semicircular in shape, where anchorage may be had, with protection from southerly winds; the soundings in the bay show from 3 to 7 fathoms water; the shores are mostly gravel beaches.

A short distance castward of Puerto de la Lancha, at the mouth of an arroyo, is a small landlocked cove, ¹/₄ mile long, and 200 yards wide at the entrance, with from 3 to 5 fathoms of water; near its head are some deserted huts.

Lobos Point, the northeastern extremity of the island, is a rocky headland 125 feet high, surrounded by detached rocks and connected with the body of the island by a low narrow strip of land.

From Lobos Point the coast turns abruptly to the southward, and for over 6 miles, to Perico Point, is a succession of rocky bluffs with occasional detached rocks, the hills immediately behind the coast rising to heights varying from 400 to 700 feet.

Perico Point is a sharp rocky cliff, surmounted by a peak of reddish color, 460 feet high. A round detached rock, 30 feet high, lies very near the point, and 150 yards southward of this rock is another, below the surface of the water.

In rounding the point it should be given a good berth, as shoal soundings are found at some distance southwest of it.

Salinas Bay.—From Perico Point the coast turns northwestward for about 2½ miles, when it turns westward, and then gradually curving southward forms Salinas Bay, where good anchorage may be found in from 5 to 6 fathoms, protected from all winds except those from southeast to south-southwest. The bottom is of sand over heavy mud, making the holding ground excellent. No pilot is required for entering and, with the exception of an occasional squall

in August and September, the anchorage is as secure as can be desired

Near the head of Salinas Bay, separated from the sea by a strip of shingle beach a little more than ½ mile wide over which the sea never flows, is a salt pond or lake, about ½ miles long and a mile wide, the water in which rises and falls with the tide, although without visible communication with the sea. This supply of salt from this pond seems inexhaustible, as the quantity taken away in one week is reproduced in the next. The salt is precipitated in the form of pure crystals, and is taken from under the water, dried, and shipped to San Francisco and Mexican coast ports, where it is ground and sold without any purification as the finest table salt. A railway connects the pond with the landing place in Salinas Bay. On the shingle beach between the salt pond and the head of the bay is a small village with a customhouse.

Water can be had at reasonable price. Fish and turtle abound in the bay, and beds of the long-shelled oyster are found.

Position.—The observation spot on the northeastern shore of Salinas Bay is in latitude 25° 59′ 37″ .2 N., longitude 111° 06′ 53″ .2 W.

White Point, at the southwestern extremity of Salinas Bay, is a steep bluff point, surmounted by a hill, off which some outlying rocks extend about 200 yards.

Gavelones Point is 2 miles south of White Point, the coast between them being steep and rocky; a sharp peak, 1,491 feet high, rises 1³/₄ miles north-northwestward from the point.

South of Gavelones Point the coast recedes somewhat and consists mostly of steep bluffs. About 2½ miles from the point is a small stream, with a short strip of sand beach on either side of the mouth, where, it is said, fresh water may be procured. A mile and a quarter farther south is the mouth of Arroyo Blanco.

Colorado Point, a little over 11 miles south of Arroyo Blanco, is a bluff point of moderate elevation and reddish color. A sunken rock reported to lie off the point was carefully searched for, but could not be found; close to the point are some detached rocks.

San Francisco Bay.—South of Colorado Point the coast recedes considerably, forming the open bay of San Francisco. After passing the point the bluffs become lower, finally terminating in a sand beach which extends to Baja Point. As Baja Point is approached, sheal water makes off some distance from the land.

The coast north of Loreto is low and sandy for about 4 miles, affording good anchorage anywhere within $\frac{1}{2}$ mile of the beach, in from 3 to 7 fathoms of water.

At Tierra Firma Point a shoal with 3 fathoms water at its outer edge extends off about 4 mile; outside this shoal the soundings

increase rapidly, 120 fathoms, rocky bottom, being found 1½ miles from the point. Three-quarters of a mile northward of Tierra Firma Point, low bluffs begin, and a mile farther is a low bluff point, with an arroyo on its southern side.

Coronados Island, lying at its nearest point 1½ miles eastward of the low bluff point just mentioned, is of irregular form, about 1¾ miles long, north and south, by 1½ miles wide at its widest part, with a height near the northern end of 928 feet; a low spit of sand and stones extends ¾ mile from its southwest side; off the point of the spit are some outlying rocks. With the exception of this sand spit the shores of the island consist of steep rocky bluffs.

Passage.—Nearly midway between Coronados Island and the mainland is a low islet surrounded by shoals, leaving a passage to the westward 800 yards wide, with a least depth of 3½ fathoms, which can be used by keeping in mid-channel. Between the islet and the scuthwest point of the island is a passage ¼ mile wide, with 4 and 5 fathoms, rocky bottom. These passages are not recommended for large vessels.

Anchorage.—To the northward of the low sand spit which makes off from the southwest side of Coronados Island is an excellent anchorage for riding out a southeaster.

Coast.—The coast north of Coronados Island, with the exception of the fertile valley and plain of San Bruno, is generally bold and rocky, the land immediately behind it rising to a height of from 1,500 to 2,000 feet.

The mouth of San Bruno Creek lies 7 miles from the north point of Coronados Island and is difficult to recognize unless close in, the course of the creek being, for $1\frac{1}{2}$ miles above its mouth, nearly parallel with the coast line, and behind a narrow strip of land on which are some high hills. The entrance is very narrow, with shoal water extending off about $\frac{1}{4}$ mile.

Mangles Point, a moderately high bluff, with a bold hill, 100 feet high, rising abruptly from it, is the southern end of a succession of cliffs of variegated color, varying in height from 200 to 300 feet.

To the southward of the point is good anchorage with protection from northwesterly winds, in from 5 to 9 fathoms of water, a scant $\frac{1}{2}$ mile from the shore; it is said that fresh water can be obtained here.

Caution.—In making for the anchorage from the southward, care must be taken to avoid some rocks, the highest of which is only 2 feet above high water, that lie 2½ miles 164° from the point, and about a mile from the nearest land to the westward; from the northward vessels may haul close around the point, as there is plenty of water, with no hidden dangers.

Mercenarios Point, lying 44 miles northward of Mangles Point, is a rocky cliff of dark sandstone, surmounted by a red cone 519

feet high. Three-quarters of a mile northwestward of Mercenarios Point is a short sandy point, with a jagged rocky bluff 50 feet high at its end, off which, close-to, are two small islets, from 10 to 30 feet high, and a rock 6 feet above water, ½ mile to the eastward; between this rock and the shore 7½ fathoms of water were found.

The coast between the two points recedes a little and is a sandy beach, with an arroyo a little more than halfway from Mercenarios Point.

San Basilio Point is a rocky cliff of red sandstone, about 50 feet high, surmounted by a hill 450 feet high; near the point, with deep water close to them, are a few outlying rocks.

San Juanico Cove, south of San Basilio Point, is a small open indentation, on the shores of which are some yellow bluffs and sand beaches; behind one of the latter is a fine-looking valley, where it is said fresh water may be procured. In the northern and western parts of the cove are a number of detached rocks, both above and below water.

San Basilio Bay.—Northward of San Basilio Point the coast recedes considerably, forming the open bay of San Basilio, off which Gull Rocks, 2½ miles (201°) off Pulpito Point, may be considered the northern limit. The shores of the bay are low bluffs, alternating with sand and pebble beaches. Soundings a mile offshore gave no bottom at 15 fathoms.

Pulpito Point is a bold headland about 500 feet high, appearing like an island when first seen from the southward, the land connecting it with the coast range being low; some detached rocks, both above and below water, extend 200 yards off the point; outside of the rocks the water deepens suddenly to 15 and 20 fathoms.

Anchorage.—There is an excellent anchorage southward of the point, in from 5 to 10 fathoms of water, about ½ mile from the beach, well sheltered from the northwesterly winds. Along the western shore of the anchorage are numerous outlying rocks, some of them over 300 yards offshore. In the northern bight is a sand beach and good landing place. A remarkable triple-peaked mountain, southwestward from Pulpito Point, is a good landmark. The tidal streams appear to be strong.

Santa Antonita Point, 1½ miles northwestward of Pulpito Point, forms the southeastern limit of San Nicolas Bay, and is a low rocky bluff, 15 feet high, with shoal water extending off it to the northward ½ mile.

San Nicolas Bay.—Northward of Santa Antonita Point the coast falls away to the westward, forming the large open bay of San Nicolas. From the southern shore of the bay the low land extends well into the interior; the western shore consists of bluffs, with

outlying rocks and high land behind the coast. Several arroyos open into the southwestern part of the bay.

Santa Teresa Point is rocky, with a small sharp hill surmounting it and many detached rocks lying off it; southwestward from the point, at a distance of 1 mile, is a conspicuous peak 955 feet high.

Ildefonso Island, its southern end bearing 6° and distant 6.2 miles from Pulpito Point, is a barren rock a little more than a mile long, $\frac{1}{2}$ mile wide, and 387 feet high; a reef of rocks projects about $\frac{1}{4}$ mile from its northern end. Soundings along the eastern shore show deep water close-to, and between the island and the mainland the water is deep, the passage being apparently free from danger.

Patches of red water are frequently met with on this part of the coast.

Colorado Point, 4½ miles northwestward of Santa Teresa Point, is a high bluff of reddish color, with many detached rocks lying off it. Between Colorado and Santa Teresa Points are several minor points off which are numerous detached rocks, both above and below water.

San Lino Bay, formed by a curve in the coast line south of Colorado Point, affords shelter from winds from southeast to west, but none from the northwest winds; the soundings in the bay show from 4 to 8 fathoms.

At 3½ miles northwestward of Colorado Point is a low point, with a gravel beach on either side, from which a reef of rocks projects a little more than ¼ mile, with shoal water some distance outside of the reef. Five and a half miles westward from this point is a conspicuous mountain, of whitish appearance, 2,434 feet high. Between the low point and Concepcion Point, a distance of over 11 miles, are several minor points with outlying rocks at a short distance. Soundings taken a mile offshore along this part of the coast show from 20 to 40 fathoms of water.

Concepcion Point, the northern extremity of the peninsula forming the eastern shore of Conception Bay, is an ill-defined bluff point about 30 feet high, with numerous rocks lying off it to the northward and westward.

From Concepcion Point the coast trends to the southwestward about 2 miles, receding slightly, to Aguja Point, which, with San Domingo Point, ½ mile beyond, forms the northeastern entrance point of Concepcion Bay.

Aguja Point is a sharp rocky bluff with some detached rocks and shoal wated a short distance off it.

Concepcion Bay, the entrance to which, between Aguja and Gallito Points, is 3½ miles wide, extends over 22 miles in a south-easterly direction and varies in width from 2 to 5 miles. In its

western part are several small islands, and a number of achorage. sheltered from all winds.

The eastern shore of the bay is regular in outline, consisting of sand and pebble beaches behind which the land slopes gradually toward the mountain range in the interior of the peninsula that separates the bay from the Gulf of California. Of several low projecting points, the most marked is San Ignacio Point, half a mile southeastward of which is a ranch near a small stream of fresh water. Except off Las Ornillas Point and for a short distance on either side of it, where deep water is found close up to the shore, shoals extend off the entire length of the eastern shore for distances varying from \frac{1}{4} to \frac{3}{4} mile.

La Pasajera.—The southern shore of the bay, known as La Pasajera, like the eastern shore, is low and sandy, the water shoaling gradually toward the beach. The road between Loreto and Mulege passes close along the southern shore and follows the western shore, generally within a mile of the coast.

The western shore of the bay is very irregular in outline, with many bluff points and intervening bights. At the southwest angle of the bay is a lagoon with some small islands at the entrance and shoal water making off about $\frac{1}{2}$ mile. Near the western shore of the lagoon is a ranch and a well.

La Tinaja Point, about a mile northward of the entrance to the lagoon, is famous for a well of the best fresh water found near the shores of the bay. The well is just above the high-water mark, 2½ feet deep by 20 inches in diameter, with sides of clay and gravel, and bottom of rock; the water in the well rises and falls with the tide, but is quite fresh.

Frigoli Point.—From La Tinaja Point the coast line is low, sandy, and nearly straight, with deep water close-to, for a little over 3 miles, to Frigoli Point, a sharp bluff point 40 feet high. After passing Frigoli Point the coast again becomes low and sandy, with shoal water extending off nearly ½ mile; near the point are several openings into an estero.

Ricason Island, 1½ miles northwest of Frigoli Point, is ½ mile long, about 200 yards wide, and 50 feet high; a narrow sand spit, only partially covered at ordinary high tides, connects it with the mainland; westward of the island, on either side of the sand spit, the water is shoal.

Ranada Point, 800 yards west of Ricason Island, is a low bluff point at the foot of some hills. From this point the coast makes a sweep to the westward, forming a small bay, the shore of which is a sand beach. Near the beach in the northern part of the bay is a ranch, and just south of it the mouth of an estero, near which fresh water of an inferior quality may be obtained. The coast for

about 3 miles northwestward of the bay is a series of bluffs, with hills from 100 to 300 feet high behind them.

Coyote Bay, which is about $3\frac{1}{2}$ miles in extent, north and south, and $1\frac{1}{2}$ miles east and west, has a number of islets and rocks with surrounding shoals, which make its navigation, especially in the northern part, somewhat difficult.

Barga Island, a barren rocky islet, 100 feet high, lies in the southern part of Coyote Bay, 800 yards from the nearest land to the southward; in the passage between it and the mainland are from 7 to 10 fathoms of water; westward of the island are some large outlying rocks.

Guapa Island, ³/₄ mile due east of Barga Island, is 80 feet high and surrounded by sunken rocks.

Rocks.—Southward of Barga and Guapa Islands, about 1,200 yards distant from both and 600 yards from the point at the southern limit of Coyote Bay, is a solitary rock about 50 feet high.

In the northern part of Coyote Bay are several small islets, from 30 to 40 feet high, surrounded by reefs and sunken rocks; in the narrow channels between them, which are not thoroughly surveyed, the soundings show from 5 to 10 fathoms water.

At the northern limit of Coyote Bay is a point with a bold rocky hill, 200 feet high, at the end, connected with the mainland by a low, narrow strip of sand; off this point shoal water extends for some distance in all directions,

San Pedro Point is a bold headland, about 100 feet high, 3 miles northward of the point at the northern limit of Coyote Bay. Shoals make off a considerable distance on either side of the point, and for about 2 miles north and south of it the navigable channel of the bay is not over 1½ miles wide. For about 2 miles northward of San Pedro Point the shore is a low pebble beach, then come bluffs of moderate height for about 1½ miles, succeeded by a sand beach that extends to within a mile of Gallito Point.

Gallito Point is a cone-shaped rock connected with the mainland by a low strip of sand and surrounded by shoal water.

Equipalto Rock.—From Gallito Point the coast is low and sandy for 2½ miles to Equipalto Rock, which is at the south side of the mouth of Santa Rosalia River, and resembles Gallito Point; the land behind the rock is low and swampy, with several small lagoons. An extensive shoal makes off from the mouth of the river and extends along the shore to the southeastward 1½ miles from Equipalto Rock, its outer edge full ¾ mile from the land throughout the entire distance.

Sombrerito Point is a pyramidal-shaped rock, 119 feet high, standing on a round pedestal at the north side of the mouth of Santa Rosalia River; for a short distance behind the point the land is low

and sandy. Colorado Peak, 836 feet high and of reddish color, stands about 1½ miles westward of Sombrerito Point, and is an excellent landmark when making for Mulege Anchorage.

Mulege Anchorage is between Sombrerito and Prieta Points. In standing in for the anchorage, steer for Colorado Peak, on a bearing nothing northward of 276°, as there is much foul ground near the coast south of that line of bearing; anchor in from 5 to 7 fathoms, 1 mile from the beach.

Mulege, situated on the banks of Santa Rosalia River, a little over 2 miles from its mouth, is a small, straggling village, the inhabitants of which are chiefly engaged in mining, pearl fishing, and raising and exporting fruits. They are said to be much more enterprising than the majority of the inhabitants of the peninsula.

Supplies.—Wood, water, and excellent fresh beef may be procured at all times, and many varieties of vegetables and fruit in their season; game is abundant in the mountains behind the village; the wines of Mulege resemble heavy port and claret, and are famous.

Prieta Point, just north of Mulege anchorage, is a low bluff of dark color, with shoal water extending off it a short distance to the northwestward.

Colorado Point, a mile northwestward of Prieta Point and the southern limit of Santa Inez Bay, is a reddish bluff of moderate height at the foot of a lateral spur of hills.

Santa Inez Bay.—North of Colorado Point the coast sweeps to the westward, forming the large open bay of Santa Inez, of which Santa Inez Point is the northern limit. The shore of the bay is generally low and sandy, and backed by low hills. Near Santa Inez Point are some conspicuous barren table hills, the highest of which, known as Barracas Table, is about 300 feet high. The soundings in the southern part of the bay range from 5 fathoms near the shore to 18 or 20 fathoms at about 1½ miles; the northern part is much shoaler, 3 fathoms being found at ¾ mile from the shore, deepening to 5 and 8 fathoms between the mainland and the Santa Inez Islands.

Standing on the beach, 5½ miles 334° from Colorado Point, is a monument marking the southern boundary of Santa Magdalena Plains. The plains are several miles in width, and extend along the coast northward of the monument; it is said that not a drop of fresh water is to be found on them, and not an acre of land that can be cultivated, so thickly is the surface covered with rocks.

The old mission of Guadalupe was situated on the northern edge of Magdalena Plain; the remains of an extensive irrigating aqueduct are still to be seen, but the mission buildings are entirely destroyed.

Santa Inez Point is low and rocky, with a small hill surmounting it. Half a mile westward of the point, in the bay, are some outlying rocks. Anchorage may be obtained under the lee of the point,

sheltered from the northwesterly winds, in from 4 to 5 fathoms water, $\frac{1}{2}$ mile from the shore.

Santa Inez Islands, three in number, lying southeastward of the point of the same name, are surrounded by shoals and sunken rocks, but between them and the point is a clear passage, through which from $4\frac{1}{2}$ to 5 fathoms may be carried. The southernmost and largest island is $\frac{1}{3}$ mile long, $\frac{1}{3}$ mile wide, and 30 feet high; its southern point is low and rocky, with shoal water extending off some distance.

The northernmost island is 15 feet high and of small extent; its center bears 111° from Santa Inez Point, distant 2 miles.

Shoal.—Directly west of the southernmost island, its center about a mile distant from it, is a shoal 1½ miles long, north-northwest and south-southeast, and ½ mile wide, with only 3 fathoms of water over it.

Eastward of the group the water deepens quickly.

Chivato Point, a low bluff with many detached rocks lying off it and a table-land from 40 to 60 feet high behind it, lies 13 miles northward of Santa Inez Point. Between Chivato Point and Santo Inez Point there are a few outlying rocks. One of these shows 25 feet above high water. A conspicuous white bluff bears 270° from this rock.

From Chivato Point the coast falls sharply away to the westward, its general trend as far as the entrance of San Lucas Cove, a distance of 14½ miles, being west-northwest. The shore is generally low and sandy, with occasional bluffs.

San Marcos Island, lying off this part of the coast, is barren and extremely hilly, about $5\frac{1}{2}$ miles long and from $1\frac{1}{4}$ to $2\frac{1}{2}$ miles wide; the highest peak, nearly in the center of the island, is 891 feet high.

The east face is chiefly composed of rocky bluffs, varying in height from 20 to 300 feet. Near the southeast extremity is a strip of sand and gravel beach about a mile long, and on the northeastern face a similar one, \(\frac{3}{4}\) mile long; off the latter beach are a number of outlying rocks; a rocky reef projects a short distance from the easternmost point of the island.

Off the north point, which is surmounted by a sharp hill, are three white islets from 20 to 40 feet high, and a number of detached rocks extending northward nearly ½ mile.

The northwest face consists of steep bluffs, with many outlying rocks, of which the two most conspicuous are 25 and 40 feet high. From the western extremity of the island to the south point the coast consists of sand beaches and bluffs from 15 to 20 feet high, the land sloping to the hills in the interior.

The south point of the island is a low sand spit nearly $\frac{1}{2}$ mile long, from which a rocky shoal extends $1\frac{1}{4}$ miles to the southward. Eastward of the low sand spit the south coast of the island is a

series of perpendicular bluffs about 30 feet high, with shoal water extending off nearly $\frac{1}{2}$ mile.

Anchorage.—There is good anchorage off the south end of the island, eastward of the low sand spit, in from 5 to 7 fathoms of water.

Water.—Fresh water may be obtained near the northern end of the island.

Lobos Rock, about 1 mile long and 20 feet high, lies $\frac{1}{2}$ mile from the south point of San Marcos Island; numerous sunken rocks surround it, and not over $1\frac{1}{2}$ fathoms can be carried through the passage between it and San Marcos.

Craig Channel, separating San Marcos Island from the mainland, is a little over a mile wide in its narrowest part, and 4 fathoms of water may be carried through it; in using it care must be taken to avoid the long shoal that makes off from the south point of San Marcos Island and Lobos Rock, with 3 fathoms on its southern edge, quickly shoaling to 2 fathoms and 1 fathom.

San Lucas Cove is a safe anchorage in all weathers for boats or small craft drawing less than 6 feet of water; it is about 2 miles long, north and south, and from ½ to ¾ mile wide; the entrance is narrow and shoal, with a small sand island nearly in the middle; the channel is on the north side of the island, and has from 1 to 1½ fathoms of water in it at low tide; inside the cove the depth of water varies from ¾ fathom to 1 fathom.

Coast.—From the entrance to San Lucas cove the coast trends northward and is low and sandy for 3 miles to a prominent point surmounted by a red mound 60 feet high; thence to Santa Maria Cove, a distance of 12½ miles, the coast is a succession of bluffs of moderate height, with intervening sand beaches, the land rising gradually to a high range of mountains in the interior. The soundings along this part of the coast show, with one or two exceptions deep water close-to, from 20 to 40 fathoms being found a mile offshore.

Santa Agueda Point, 5 miles northwestward of Red Mound and the eastern entrance point of a lagoon and canyon of the same name, is low and sandy, with a shoal extending $\frac{1}{2}$ mile off it and across the entrance to the lagoon; outside the shoal the water deepens quickly, 60 fathoms being found at $\frac{1}{2}$ mile. A short distance northwestward of the point is a large rock, 15 feet high.

There are six valleys or canyons, about a mile apart, between Santa Agueda Point and Santa Maria Cove, which are widely known for their yield of rich copper ore. In anchoring off these canyons the lead must be kept constantly going, as the water is deep to within 4 mile of the shore and then shoals suddenly.

Santa Rosalia, a mining settlement, in latitude 27° 20′ N., contains a population of about 3,000, mostly French, Belgians, and Mexicans, about half of whom were employed in the mines; the remainder includes their families and dependents. The concession to the Boleo Co. (French) extends 5 miles east and west and 10 miles north and south.

The town is divided into two parts: One, the French town, called La Mesa; the other, to the south of the first, called La Playa, inhabited by the Mexican population. An aqueduct brings to the town fresh water from the Santa Agueda Arroyo, about 2 miles distant.

The anchorage, an open roadstead, is in from 13 to 7 fathoms of water, good holding ground, but close to the shore. From 14 fathoms the water shoals very suddenly, and vessels generally anchor in 8 fathoms and haul their sterns in to the shore for convenience in warping off boats. Landing is easy during nine months of the year, but is often interrupted during November, December, and January.

The port, which was constructed by the Boleo Co., has the form of a trapezium, with an area of about 40 acres, and is dredged to 32 feet as far as the 3-fathom line, parallel with the shore and passing the extremity of the loading mole. The northern jetty extends 82° for a length of 350 yards and then turns to 152° for about 550 yards. The southern jetty extends 40° for a length of 200 yards. The entrance of the port between the extremities of the two jetties has a width of about 100 yards; the light on northern jetty bears 80° from that on southern jetty.

The loading mole, halfway between the two jetties, has a length of 108 yards. At the mole terminate the numerous railroads serving the mines, and here are located the workshops, the foundries, and the storehouses of the company. Vessels drawing up to 25 feet can be berthed alongside the wharves.

Winds.—The northwest winds blow generally along the shore, raising a sea uncomfortable for boats, but not dangerous to shipping.

Supplies are controlled by the Boleo Co. Water is supplied in casks. Ballast is delivered in large lighters. Provisions are dear.

Communications.—A steamer belonging to the Boleo Co. leaves for Guaymas once a week. There is also communication with Guaymas by radiotelegraph.

Santa Rosalia Lights.—There is a green electric light on the southern end of the outer breakwater and a red electric light on the extremity of the south mole. These lights are visible about 4 miles.

Directions.—Vessels bound for Santa Rosalia should make Tortuga Island, and then steer inshore until the chimneys of the smelting works are visible. At night the glare of the furnaces and the electric lights of the town offer a good mark until the lights on the breakwater are made out.

Pilots do not go off to vessels at night or in very rough weather. Pilotage is compulsory.

Santa Maria Cove, 7½ miles northwestward of Santa Agueda Point, is an indentation about ¾ mile wide and ¼ mile deep; the southern shore is rocky, with bluffs and low hills behind it; on the north side the land is hilly, ending in a sharp bluff point, with numerous outlying rocks off it; at the head of the cove is a sand and shingle beach. Anchorage may be had in Santa Maria Cove, about ¼ mile from the beach, in 5 or 6 fathoms of water, sheltered from northwest winds, but exposed to southeasters.

Tortuga Island lies 23 miles nearly due east of Santa Maria Cove, its highest peak bearing 48° from the north end of San Marcos Island, distant 15½ miles. It is mountainous and barren, about 2 miles long, by a mile wide at the middle, narrowing toward the ends. The highest peak, near the southern shore, is 1,016 feet high.

Coast.—From the northern limits of Santa Maria Cove the coast first trends nearly north for 3½ miles, and then gradually falls away to the northwestward for 3 miles farther to Cape Virgenes. The shore is of broken bluffs, varying in height from 30 to 200 feet, with occasional gravel beaches and deep arroyos.

The depth of water off this part of the coast is very great, soundings within 1½ miles of the shore showing no bottom at 300 fathoms.

La Tres Virgenes are three remarkable mountains, standing nearly parallel with this part of the coast, from 12 to 14 miles inland, the highest with an altitude of 6,547 feet.

Cape Virgenes is a rocky cliff about 200 feet high, surmounted by a hill 600 feet high, the high coast range lying a short distance inland. Soundings off the point give 5 fathoms close-to, deepening rapidly to 130 fathoms a mile off. Northwestward of Cape Virgenes the coast is generally low, the mountain range being several miles in the interior.

Baja Point, 4½ miles from Cape Virgenes, is of shingle, with a shoal extending off a short distance. Just south of the point is the mouth of a canyon which leads up to a silver mine, known as Reforma. About ¾ mile southeastward of the point is a landing place, marked by a flagstaff with a white flag.

Santa Ana Point, 7½ miles farther up the coast, is steep, with hills 400 feet high immediately behind it, and forms the eastern limit of Santa Ana Bay, an indentation about 3½ miles wide and from ½ to ¾ mile deep. The southern and western shores of the bay consist of sand and shingle beaches, the low land behind them sloping gradually to the mountains. The water is very deep to within a short distance of the shore.

Anchorage may be had, with shelter from southeasters. The western limit of the bay is a low shingle point, off which a shoal extends for over ‡ mile. At the point is the opening to a small lagoon, into which flows Santa Ana Creek. This fresh-water creek may be recognized by the grass and trees on its banks.

Two and three quarters miles northwestward is another low point and an opening to a lagoon, with a shoal surrounding it.

Trinidad Point, 8½ miles from Santa Ana Point, is a prominent headland, 250 feet high, surmounted by moderately high bluffs; several detached rocks lie off it; the intermediate coast has a more northerly trend and is generally bluff, with several outlying rocks and a range of hills rising immediately behind it.

San Carlos Bay is an open bay northward of Trinidad Point. About $1\frac{3}{4}$ miles from the point is a small rocky islet of whitish color, the highest part 6 feet above high water, with shoal water extending from it a short distance on all sides. Between the islet and Trinidad Point is a sandy bight, with shoal water extending nearly $\frac{1}{2}$ mile offshore. At $3\frac{3}{4}$ miles from the white islet is a rocky point surrounded by numerous detached outlying rocks, one of which, nearly $\frac{3}{4}$ mile north of the point and $\frac{1}{2}$ mile fro mthe nearest shore, is $\frac{1}{4}$ mile long and 6 feet high.

San Carlos Point is low, composed of sand and shingle, and may be recognized by Sharp Peak, about 5,000 feet high, 9½ miles nearly west from it.

Red water.—Along this part of the coast extensive patches of the red water before mentioned were met with; soundings made while steaming through them gave no bottom at 55 fathoms.

Coast.—From San Carlos Point to Cape San Miguel, a distance of 12 miles, the coast trends nearly north and is for the most part low, with sand and gravel beaches and an occasional low bluff, until within about 2½ miles of Cape San Miguel, whence to the cape is an almost continuous bluff about 50 feet high. Behind the coast the land slopes gradually to the hills and is covered with low bushes and cactus.

San Juan Bautista Point, 43 miles northward of San Carlos Point, is low and composed of sand and gravel; shoal water extends off it 1 mile.

Between the two points the coast recedes about a mile, forming the open bay of San Juan Bautista, the soundings in which are very regular. A little northward of San Juan Bautista Point the hills approach the coast, ending in bluffs.

Cape San Miguel, is a bold, rocky, bluff, 150 feet high with several outlying rocks a short distance to the eastward. Anchorage, sheltered from the northwest winds, may be found just south of the cape, in 7 or 8 fathoms of water, ½ mile from the shore.

A mile south of the cape is the northern end of a shoal that extends nearly 2 miles along the shore to the southward, with only

 $2\frac{1}{4}$ fathoms of water on its outer edge, which is from $\frac{1}{4}$ to $\frac{1}{2}$ mile offshore.

Coast.—From Cape San Miguel to Santa Teresa Point, a distance of 13½ miles, the coast is generally low, consisting of alternate sand beaches and low bluffs, the coast range lying a short distance inland. Just north of Cape San Miguel the coast sweeps to the westward, forming an open bay.

Santa Teresa Point is a rocky bluff about 30 feet high, the land behind it rising abruptly to a height of 567 feet. South of the point is the small open bay of the same name, at the head of which is a sand beach, with low land behind it extending across to San Francisquito Bay; in the southern part the shore consists of rocky bluffs backed by hills about 150 feet high and fronted by some outlying rocks.

Good anchorage, sheltered from the northwest winds, may be found about 1 mile from the beach, in 8 or 9 fathoms of water, the point bearing 28°, distant 600 to 800 yards.

On the low neck of land between Santa Teresa and San Francisquito Bays is the extensive bed of a fresh-water pond, dry during 8 months of the year.

San Pedro Martir Island, lying in mid-gulf, 27½ miles from Cape San Miguel and 28 miles from Santa Teresa Point, is a barren, triangular-shaped rock, less than a mile in extent either way, its highest point 1,052 feet high; off the southern face are several detached rocks, some of them ½ mile from the shore.

Coast.—Northward of Santa Teresa Point, between it and San Francisquito Bay, is a prominent headland, with barren hills, from 300 to 500 feet high, and a rugged bluff coast.

San Gabriel Point, 1.2 miles north of Santa Teresa Point, is a rocky bluff 45 feet high, with high volcanic hills just behind it and numerous detached rocks surrounding it. Just west of the point is a strip of sand beach 4 mile long, and then a rocky point, similar to San Gabriel Point, forming the eastern entrance point of the bay.

San Francisquito Bay, which is about a mile in width between the heads and the same in depth within them, is open to the north and northeast, but affords good shelter from either northwest or southeast winds, the prevailing ones in the gulf. A small land-locked cove opens into the southern part of the bay, with shoal water, and a narrow entrance between two rocky points, 300 yards apart, with numerous outlying rocks, which narrow the passage to about 100 yards. The country in the vicinity of the bay is extremely barren and stony.

Anchorage.—The best anchorage is in the southwest part of the bay, in from 5 to 6 fathoms of water, about $\frac{1}{4}$ mile off a sand beach $\frac{1}{2}$ mile long and flanked on either side by rocky bluffs.

Coast.—From the northwest point of the entrance to San Francisquito Bay to San Francisquito Point, a distance of 2 miles, the coast consist chiefly of steep rocky bluffs, with table-land from 300 to 400 feet high immediately behind them.

San Francisquito Point is a low rocky bluff, with a number of detached rocks lying off it, close-to. At the foot of the hills, a short distance west of the point, is said to be a place where fresh water may be found.

Sal si Puedes Channel, which lies between the mainland on the west and the islands of San Lorenzo, Sal si Puedes, Raza, and Partida on the east, is a wide deep channel through which the currents set strongly, especially with an ebb tide and a northwesterly wind, against which sailing vessels find it almost impossible to make any headway. Soundings in the northern part of the channel 2½ miles from the shore near Las Animas Point, gave a depth of 716 fathoms, bottom of green ooze; and in several places between the island of San Lorenzo and the mainland no bottom was found at 320 fathoms.

Anchorage may be found near the western shore and also in the vicinity of the islands of Raza and Partida; but there are few such places, owing to the great depth of water in most parts of the channel.

San Lorenzo Island, the southernmost and largest of the islands forming the eastern side of Sal si Puedes Channel, is 12½ miles long and from 1 to 2 miles wide. Like most of the islands in the gulf, it is of volcanic origin, high and barren. The highest peak, near the southern end, has an elevation of 1,592 feet. Three miles from the northwestern end of the island is a narrow boat passage, really making two distinct islands.

Landings.—Three miles to the southeastward of the boat passage, on the west side of the island, is a slightly projecting sand beach where a landing may be effected in smooth weather, and at the southeast extremity of the island is another small strip of sand beach which, with the prevailing northwesterly winds, affords a good landing place. With the exception of these sand beaches the shores are bold, with rocky bluffs predominating.

Rock.—About 1½ miles nearly due east of the northwest point of the island, and 300 yards from the nearest shore, is a detached white rock 20 feet high.

Sal si Puedes Island, lying a mile northwest of San Lorenzo, is about $1\frac{1}{2}$ miles long, with a greatest width of $\frac{1}{2}$ mile. The highest peak, near the southern end, is 376 feet high. Several detached rocks lie off the island, one of which, near the northwest end, is 50 feet high.

Rock.—Nearly midway between Sal si Puedes and San Lorenzo Islands, a little nearer the former, is a rock awash, and it is prob-

able that there are other hidden dangers in the passage, which has not been examined and is not recommended for use.

Raza Islet, 4\frac{3}{4} miles north of the northwest point of Sal si Puedes, is about \frac{3}{4} mile long, east and west, \frac{1}{2} mile wide and about 100 feet high, presenting a whitish appearance from the deposit of guano. The shores consist chiefly of moderately high bluffs, with outlying rocks close-to.

Anchorage in from 5 to 8 fathoms, gravel and rocky bottom, will be found on the south side of the island, about 600 yards from the shore, abreast of a landing pier, house, and flagstaff. A reef of rocks projects a short distance from the southeastern end of the island, and should be given a good berth.

Raza Rock, a small white rock, 75 feet high, lies a little over a mile 307° from the northwest point of Raza Islet. There is deep water, free from dangers, on all sides of it except the southwestward, where, at a distance of 400 yards, is a rock awash, with 20 fathoms of water close-to.

Remarks.—The tidal currents in the vicinity of these islands are very strong, sometimes causing heavy tide rips. Northwest winds prevail from November to June, and frequently blow with great violence for two or three days at a time.

Partida Island, so called from its divided appearance when seen from a distance, lying 4½ miles, 318° from Raza Islet, is about 1½ miles long by ½ mile wide, and has two peaks, each 400 feet high, joined by a low narrow strip of land.

On the western side of the island is a small cove or bight, open to the northward, in which are from 3 to 8 fathoms of water. A rock 85 feet high lies off the steep bluff point which forms the western side of the bight.

Off the eastern side of the island, about 700 yards distant from it, is a small islet, 75 feet high; between this islet and Partida Island anchorage may be found in from 5 to 20 fathoms, with shelter from the northwest winds.

White Rock, 1,200 yards northward of Partida Island, is 175 feet high, and from it a reef makes off to the northward about $\frac{1}{2}$ mile, ending in a rock 2 feet above water at low tide. The soundings are irregular, with rocky bottom, for about $1\frac{1}{4}$ miles farther north, and then increase rapidly.

San Rafael Bay, the large open bay north of San Francisquito Point, affords good protection from southerly winds. Its shores consist chiefly of sand beaches, with occasional low bluffs, the land sloping gradually toward the interior, cut by numerous ravines and covered with vegetation. Soundings in the southern part of the bay gave 40 fathoms at a mile from the shore, while in the northern

and western portions at the same distance from 10 to 20 fathoms were found.

From the northwestern limit of San Rafael Bay to Las Animas Point the coast consists of rocky bluffs, with mountains rising immediately behind it.

Bernabé Rocks, two in number, lying 3½ miles southeastward of Las Animas Point and from 600 to 800 yards off a low slightly projecting point, are only 2 feet above water, and between them and the shore is a shallow passage with rocky bottom, fit only for boats.

Anchorage.—There is fair anchorage southward of the rocks in 7 or 8 fathoms of water, coarse sand bottom, about 1 mile from the beach.

Las Animas Point is a bold rocky bluff, from 75 to 125 feet high, with several detached rocks close-to; behind it steep hills of a reddish color rise abruptly to heights varying from 300 to 500 feet, with mountains over 2,000 feet high a short distance inland. The water off the point is very bold, 60 fathoms being found within less than $\frac{1}{2}$ mile. This point forms the southwestern entrance point of Ballenas Channel.

Ballenas Channel, between the mainland and Angel de la Guardia Island, is about 45 miles long and from 8 to 13 miles wide. The northwest winds sometimes blow through the channel with great force, raising a heavy sea against which a vessel can make but little headway. The tidal currents are at times very strong; as much as 3 knots has been experienced.

Soundings obtained within less than a mile from the shore of Angel de la Guardia gave 205 fathoms, and the water throughout the channel is believed to be very deep.

Las Animas Bay.—From Las Animas Point the coast turns southwestward for 5½ miles, to the mouth of a small lagoon, whence it sweeps around to Las Animas Point, 6½ miles distant, forming this large bay, where good anchorage may be had, with protection from either of the prevailing winds.

The shores of the bay consist chiefly of sand beaches, with a few bluffs between Las Animas Point and the entrance to the lagoon.

About 2 miles northwestward from the lagoon entrance is a steep bluff point, surmounted by a brownish-colored mound, 80 feet high, off which are several islets, varying in height from 30 to 75 feet.

The best anchorage is in the southern part of the bay, in from 6 to 12 fathoms, nearly on a line between the islets and the lagoon entrance, with care not to approach the latter within $\frac{3}{4}$ mile.

The point at the northwestern limit of the bay is a sharp rocky bluff, from 25 to 40 feet high, surmounted by a dark hill 100 feet high.

About ½ mile north of the point, and connected with it by a rocky shoal, is a low islet, only 2 feet above high water.

About 1½ miles north-northwestward from the point is another prominent sharp bluff point, formed by a spur of reddish hills from 200 to 300 feet high. The coast between the two points forms a bight a mile deep, with a sand beach at the bottom.

Rocky Islet, $1\frac{1}{2}$ miles farther up the coast, is a barren rock, 75 feet high, lying $\frac{1}{2}$ mile offshore, with a 3-fathom passage between it and the beach, which is of sand.

From here to the entrance to Angeles Bay the coast is a succession of sharp rocky points, with outlying rocks close-to, the land rising abruptly to heights of over 3,000 feet.

Angeles Bay, a fine sheet of water covering an area of about 25 miles, is almost completely landlocked, having for its protection on the east and northeast no less than 15 islands and islets. The shores of the bay are for the most part sand beaches, with one or two rocky bluffs. In the southern part, shoal water extends some distance from the shore.

Three deep and safe passages lead into the bay. The southernmost is between Red Point (a reddish, rocky bluff) and two small islets, 50 and 70 feet high, about 600 yards northward of it; this channel is believed to be entirely free from hidden dangers and has a depth of from 20 to 30 fathoms. Another safe passage, 1 mile wide, with from 20 to 30 fathems of water through the middle, lies to the northward of the two islets, between them and an island of a dark reddish color, on the southern face of which is a hill, 225 feet high, with a stone monument on it. The passage northward of the last-mentioned island contains many sunken rocks and rocks awash, with deep water close to them, and is not recommended. On the other side of this dangerous passage is a group of islands, varying in height from 90 to 125 feet, with deep water and no dangers between them and the mainland. The northern passage leads between Smith Island and a long, narrow neck of land that projects in a southeasterly direction from the mainland and is terminated by a rocky bluff, and then between the bluff and the group of islands before mentioned; it is over a mile wide and free from dangers, except where some dangerous rocks, lying 1,500 yards from the middle of Smith Island, narrow the channel to 1,800 yards; over 10 fathoms water can be carried through it. The deep bight in the northern part of the bay, west of the long neck of land, was not examined.

Anchorage.—The best anchorage is in the western part of the bay, off the mouth of a small cove formed by a low sand spit extending to the southward, where in 8 fathems of water shelter will be had from all winds.

Tides.—Springs rise about 12 feet.

Supplies.—Water can be obtained from springs near the anchorage, at the foot of Round Top Mountain; their situation is marked by a growth of weeds and bushes. The bay abounds in fish and turtle, and good oyster can be gathered along the rocky shores.

Directions.—To enter by the southernmost passage: Steer for Round Top Mountain, 3,423 feet high, on a bearing 251° until nearly up with Red Point, then keep in mid-channel and steer 270° for the anchorage.

To use the northern passage: Keep well over toward the mainland, to avoid the dangerous rocks westward of Smith Island, and, after passing between the extremity of the long narrow neck and the group of islets to the southward, keep at least a mile from the land to avoid a shoal that makes off from it; when the point of the low sand spit bears 282° haul up for the anchorage.

None of these passages should be attempted unless in an emergency, when the land can be plainly distinguished, as the land is the only guide.

Smith Island, the northernmost and largest of the islands fronting Angeles Bay, is high and flat topped, nearly 4 miles long, from ½ to over ¾ mile wide, and 1,554 feet high at its northwestern end, off which is an islet 60 feet high, separated from it by a narrow boat channel. Off the western face, about midway of its length and connected with it by a rocky shoal, lies an islet 75 feet high, about ½ mile to the northwestward of which, and ¾ mile from Smith Island, are some dangerous rocks.

A white rock, 40 feet high, with deep water all around it, lies a little over ½ mile southward of Smith Island, and 1½ miles to the southeastward is a small flat-topped island, from 90 to 125 feet high.

Coast.—The coast north of Angeles Bay to within 3 miles of Remedios Point is composed of rocky bluffs, with short pebble beaches intervening. The land behind the coast is very much broken, with mountains from 1,500 to 2,000 feet high. Near the northern end of this rocky strip of coast and close to the shore are three small islets about 1½ miles apart and from 15 to 30 feet high; the two southern ones are of whitish color.

Remedios Point is low and sandy, with hills rising to the northward and westward toward the coast range, a short distance inland.

Remedios Bay is an open bay southward of Remedios Point. A sand and pebble beach extends about 3 miles from the point, and near its southern limit is a small lagoon. Anchorage may be found here, with shelter from the northwest winds; the best is off a red hill 200 feet high $\frac{1}{3}$ mile from the shore, in 10 fathoms of water, Remedios Point bearing about 30°, distant $1\frac{3}{4}$ miles.

Coast.—From Remedios Point to Bluff Point, a distance of 26 miles, the coast trends northwestward, with no anchorage or shelter for the entire distance; it is an almost unbroken succession of high rocky bluffs, ranging from 50 to 150 feet in height, the coast range of mountains rising immediately behind it.

Bluff Point, the northwestern entrance point of Ballenas Channel, is a bold rocky bluff about 100 feet high, and may be recognized from a distance by Sharp Peak, 3,189 feet high, 6.6 miles 242° from it. Double Peak, 5,440 feet high, bears 209° from the point, distant 13.4 miles.

Angel de la Guardia Island is high, rocky, and barren, with a length of over 40 miles parallel with the coast, and a greatest width of about 10 miles. A range of mountains from 3,000 to over 4,000 feet high, and highest in the northern part, traverses its entire length; a comparatively low ridge, about midway of the island, connects the high northern and southern portions.

The whole western side of the island, bordering on Ballenas Channel, is inaccessible and without anchorage.

Humbug Bay, nearly opposite Remedios Bay, has a steep sandy shore, but the water is said to be too deep for anchorage, even close to the beach. Just north of this bay is a bold bluff point, between which and Remedios Point is the narrowest part of Ballenas Channel, here only 8 miles wide.

The south extreme of the island is a sharp bluff point, a mile to the northward of which is a hill, 772 feet high, descending abruptly to the shore on the east and west sides.

The eastern side of the island is very irregular in outline, and has several open bays where vessels may anchor and be sheltered from the prevailing winds. The shore is generally bold, with rocky bluffs predominating.

From the south end the coast trends nearly north for about 3 miles, where it becomes low and assumes a northeasterly direction, terminating in a sharp point from which a rocky reef, partly dry at low water, extends to Pond Island.

Pond Island is about a mile long, ‡ mile wide, and over 400 feet high, with nearly perpendicular cliffs, and some outlying rocks on its northeastern side.

About 300 yards eastward of the reef connecting the island and the point is a high detached rock, with a rock awash between it and the reef.

Anchorage may be had, with protection from the northwesterly winds, off a small strip of sand beach just where the coast commences to curve to the northeastward, about 3 miles from the south point of the island, in from 7 to 9 fathoms of water, less than ‡ mile from shore.

Rock Point, 17 miles from the south end of the island, is a bold headland with cliffs over 500 feet high, surmounted by a hill 1,943 feet in height, the northeast end of a spur of very high and steep mountains projecting from the main range.

The coast between Pond Island and Rock Point recedes considerably to the westward, forming an open bay with good anchorage in its southern part, protected from southeasterly winds. The shore near this anchorage is a sand and gravel beach, and the soundings increase gradually seaward.

Anchorage may also be had just south of Rock Point, close inshore, in from 5 to 8 fathoms of water, with some protection from the northwest winds.

Between Rock Point and the next prominent point to the north-westward, a distance of 12 miles, the coast recedes nearly 4 miles, forming a large open bay, the shores of which are chiefly pebble beaches, with a few small bluff points in its southern portion. The land slopes upward to a moderately high table-land and is covered with cactus.

About 2 miles south of the northern limit of the bay is a small lagoon with a narrow opening to the sea.

From the bay the coast trends northwestward, 14½ miles to Bluff Point, and is a succession of rocky bluffs. At 5 miles from the northern limit of the bay is a low, slightly projecting point and an arroyo.

Bluff Point is a bold rocky headland, with rocky bluffs from 100 to 300 feet in height extending about a mile on either side of it.

Puerto Refugio, included between Granite and Mejia Islands and the north side of Angel de la Guardia, is a fine large harbor, or more properly two harbors, easily accessible from the east, the north, and the west, with good anchorage, sheltered from all winds.

The eastern harbor, and larger of the two, is about 13 miles long and wide, and is entirely free from hidden dangers; in the southwestern part a spur of hills, terminating in a rocky bluff point, projects 3 mile into the bay, and from its extremity a rocky shoal extends northward about 300 yards.

Granite Island, fronting the eastern harbor, is a little over \(\frac{3}{4}\) mile long, \(\frac{1}{6}\) mile wide, and from 172 to 281 feet high; it is entirely barren and extremely rocky. The eastern point is low and stony, with a white rock, 15 feet high, close-to; off the southwestern end are several detached rocks awash and below water; a reef, with one rock 13 feet above low water, projects 200 yards from the northwest point. The passages on either side of the island are over \(\frac{3}{4}\) mile wide, with from 15 to 30 fathoms of water.

White Rock, a large rugged rock of whitish color, 41 feet high, lies nearly in the center of the eastern harbor, with from 7 to 13 fathoms of water close around it.

Anchorage.—The best anchorage will be found in the southern part of the harbor, in 6 to 8 fathoms, sand, White Rock bearing about north, distant about 3 mile. Vessels may also anchor south of Granite Island in from 8 to 12 fathoms, but the bottom is mostly rocky.

Tides.—The corrected establishment of the port is 0h. 25m.; spring range 11.8 feet.

Position.—The observation spot, about the middle of the southwest shore of Mejia Island, is in latitude 29° 33′ 7″.8 N., longitude 113° 35′ 19″.2 W.

Directions.—To enter the eastern harbor by either the eastern or northern entrance, bring White Rock to bear about midway of the entrance and steer for it, passing it at a reasonable distance. Then steer for the anchorage.

Mejia Island is hilly and barren, over $1\frac{1}{2}$ miles long, $1\frac{1}{4}$ miles wide, and, near the northwest point 857 feet high. With the exception of some stretches of sand beach on the southeastward side, the coast is a continuous rocky bluff, attaining on the northwest face a height of 500 feet.

South of the easternmost point a shallow cove, with some small islets in it, extends more than halfway across the island. Off all the more prominent bluff points are outlying rocks, and from the northernmost point a dangerous reef of rocks, above and below water, projects 800 yards in a northerly direction. Care must be taken to avoid this reef when using the northern passage into the harbors.

Between the eastern end of Mejia Island and the north end of Angel de la Guardia is an island over ½ mile long, with a greatest width of 400 yards, and 250 feet high; a rocky reef connects the south end with Angel de la Guardia; between the north end and Mejia Island is a channel 150 yards wide, with from 7 to 10 fathoms of water, which connects the two harbors.

The western harbor is a little over a mile long and $\frac{1}{2}$ mile wide, and may be entered either at its southwest end, between Monument Point, the south point of Mejia, and a group of rocks lying off the northwest point of Angel de la Guardia, or at its northeast end, with a leading wind or in a steamer, by the channel that connects the two harbors.

Rocks.—From ½ to ½ mile westward of the northwest point of Angel de la Guardia is a dangerous group of rocks, some of them awash at low water; the passage between this group and the island is not recommended.

Sail Rock is a sharp conical rock, 167 feet high, lying $1\frac{3}{4}$ miles 230° from Monument Point, with 16 fathoms close to it.

Directions.—To enter the western harbor, being northward of Sail Rock, steer for the middle of the entrance, keeping White Rcck, in the eastern harbor, in range with the south end of the island that separates the two harbors, until the eastern point of Mejia Island bears 34°, where the best anchorage will be found, in from 6 to 7 fathoms of water, bottom sand and shells.

To pass through into the eastern harbor from the anchorage in the western harbor, steer for the north point of the island separating the two harbors until the middle of the channel between it and Mejia Island bears 27°, which course leads through in not less than 4 fathoms of water.

Coast.—From Bluff Point, on the mainland, the coast trends northwestward, and with the exception of a small stretch of low beach 5 miles from Bluff Point is high, rocky, and precipitous as far as Point Final, a distance of 201 miles.

Point Final is a rocky bluff point of moderate height, with low land in the interior southwestward from it.

San Luis Gonzales Bay.—From Point Final the coast turns sharply to the southwestward, and, sweeping around in a semicircle, forms the open bay of San Luis Gonzales, which affords good anchorage, protected from southeasters but open to the northward. The shore of the bay is a low sand and gravel beach. In the southern part is the Calamujuet Arroyo, on the bank of which, 12 miles to the southward, are the ruins of the old mission of the same name, and near them some pools of tolerably good fresh water.

Willards Point, the northern headland of San Luis Gonzales Bay, about 8 miles northwestward of Point Final, is about 185 feet high.

Willards Bay runs in a northwesterly direction 5 miles from Willards Point, and is then separated from a lagoon by a narrow strip of sand. The lagoon is shallow, and abounds in turtle, fish, and game. The bay is apparently free from hidden dangers, and affords shelter in all weather and from all winds. There is a depth of from 5 to 10 fathoms of water, and even near the mouth of the lagoon there is said to be 5 fathoms within \(\frac{1}{4}\) mile of the shore. A poor quality of fresh water was found near the shore of the northern part of the bay. The rise and fall of the tide is said to be 14 feet. This bay does not apear on the charts.

Coast.—The coast to Point San Fermin is most low and sandy, with but few bluffs. The land behind the coast slopes upward to broken hills and table lands 1,000 to 1,500 feet high.

Several islets lie off this part of the coast, and the water is comparatively shoal, 12 fathoms being found at $2\frac{1}{2}$ miles from the shore and 15 fathoms at 5 miles.

San Luis Island is a small island of volcanic origin, 729 feet high, lying 13 miles northwestward of Point Final, with a clear channel 1½ miles wide between it and the mainland. A low sand spit extends nearly a mile from the southwestern side of the island, with shoal water extending nearly ½ mile off from it on either side.

Good anchorage may be found on either side of the sand spit, on the southeast side with northwesterly winds and on the northwest side during southeasters, care being taken not to approach on either side within 1 mile.

Cantada Island, about 400 yards from the northern end of San Luis Island, and connected with it by a reef that is bare at low water, is a recky islet 478 feet high. A dangerous rock about 3 feet above low water lies 1½ miles 349° from Cantada Island, with 19 fathoms close to it, and 2½ miles 317° from Cantada is a circular reef over ½ mile in diameter, of rocks, some covered and some awash at low water, with deep water close-to.

Another rock, awash at low water, lies a mile nearly due north from the northwest end of San Luis Island.

Islets.—Parallel with the coast, and from 3 to 4 miles from it, are three small islets, respectively, 354, 559, and 626 feet high, and distant from San Luis Island, respectively, 4, 6, and 9 miles. A third of a mile eastward of the southernmost of these islets is a large outlying rock. From the middle islet a low sand spit and shoal extends over ½ mile to the southwestward.

About 5 miles northwestward of the northernmost islet, and less than a mile from the mainland, is a large rock, 75 feet high.

Red Bluff, about 20 miles northwestward of San Luis Island, is a conspicuous bluff of reddish color, 100 feet high, behind which is a series of table-shaped hills from 1,000 to 1,500 feet high. The trend of the coast is here almost due north.

Point San Fermin is a low sand point, not well defined. Immediately south of it is an anchorage with some protection from the northwesterly winds. Rugged Peak, 3,413 feet high, 10\frac{3}{4} miles west-southwestward from the point, serves as a good landmark. Spring tides rise about 18 feet.

Coast.—From Point San Fermin the coast trends north as far as Diggs Point, a distance of 27 miles, whence it falls away to the westward. The shore throughout the entire distance is low and sandy, the coast range, a few miles in the interior, rising to a height of about 1,000 feet. The soundings at from 2½ to 4 miles offshore show depths of from 8 to 15 fathoms.

Diggs Point is low and sandy, projecting only slightly from the general coast line.

Point San Felipe, 13 miles northwestward from Diggs Point, is a dark rocky headland, surmounted by a dark hill which rises abruptly to a height of 940 feet.

San Felipe Bay, south of the point, affords some shelter from the northwesterly winds. The shore of the bay is mostly low and sandy, but in the northwestern part are some rocky bluffs. The water in the bay is quite shoal, less than 3 fathoms at low water being found a mile offshore.

Anchorage.—The best anchorage is in the northern part of the bay, in from 4 to 5 fathoms at low water, muddy bottom, with the dark hill over Point San Felipe bearing 325° and Sharp White Peak, 4,288 feet high, 244°.

Spring tides rise about 20 feet.

Calamahue Mountain, sometimes called Santa Catalina, from the old mission of that name near its foot, rises to a height of 10,126 feet, 28½ miles westward of Point San Felipe, and is the highest mountain in Lower California. It has a whitish appearance, with a jagged top, and can be seen in clear weather from a distance of over 100 miles.

Consag Rock, sometimes called Ship Rock, from its resemblance to a ship under sail, lies 18½ miles 78° from Point San Felipe; it is small in extent, 286 feet high, and covered with guano, which gives it a whitish color; a number of detached rocks, some of them over 25 feet high, lie from ½ to ½ mile westward of it. Soundings between the rock and Point San Felipe show from 10 to 15 fathoms of water, with generally muddy bottom. The tidal currents cause heavy rips in this vicinity.

This rock is an excellent mark for shaping a course to the mouth of the Colorado River.

The coast from Point San Felipe to Sargents Point at the mouth of the Colorado River, a distance of about 37 miles, trends nearly due north, and is low, with plains rising gradually toward the mountains in the interior. Mud flats and shoals, bare at low water, extend offshore from 1½ to 6 miles. Parts of this coast are subject to overflow at times in heavy freshets and highest spring tides.

Ometepes Bay is about 27 miles north of Point San Felipe, in latitude 31° 30′ N., longitude 114° 52′ W. The entrance is 300 feet wide and ¼ mile in length, with a depth of 3 fathoms at half tide. The bay, circular in form, is about 3 miles in diameter and perfectly landlocked, with a depth of 5 fathoms of water, and free from hidden dangers. The bay abounds in turtle, fish, and game.

The rise and fall of the tide is said to be 25 feet.

Colorado River has its source in the Rocky Mountains, being formed in Utah by the union of the Green and the Grand Rivers,

the former rising in Wyoming and the latter in Colorado, and after a course of about 1,000 miles enters the head of the Gulf of California. At 75 miles from Philips Point, within the entrance, it is joined by the Gila River from the eastward, and here, at the junction, a few miles north of the Mexican boundary, is Yuma, Ariz., a station on the main line of the Southern Pacific Railway, and the first river station of the Colorado Steam Navigation Co. Fronting Yuma, on the west bank of the Colorado, is Fort Yuma, in San Diego County, Cal.

The entrance to the Colorado River may be considered as lying between Shoal Point, on the Sonora shore, and Sargent Point, 27 miles westward from it, on the coast of Lower California; it is much obstructed by mud flats, which are bare at low-water springs, but have navigable channel between them at high water. The two islands at the entrance, Montague and Gore, are subject to overflow at high-water springs.

Shoal Point is a low sandy point, with a barren sand hill about 300 feet high immediately behind it. The water is shoal for about ½ mile off the point, and a shoal spot with 2½ fathoms least water lies from 2 to 4 miles northwestward of it. Between this shoal and the shore is a channel over ¼ mile wide, with from 5 to 7 fathoms of water.

Tides.—High water, full and change, at Shoal Point is at 0h. 30m., approximate.

Direction Sandhill.—About 9 miles northwestward of Shoal Point the beach projects slightly, and behind it are some sand cliffs at the foot of the hills which form the lateral spurs of a long barren table-land. Direction Sandhill, which lies behind this projecting beach, is 556 feet high, and easily recognizable from the neighboring hills by a growth of bushes at its foot. It is an excellent mark for entering the river.

Shoal.—Off the point just mentioned is a shoal with only 9 feet of water is in its shoalest part; between it and the shore is a channel, 3 mile wide, through which 6 fathoms may be carried at low water. There is also a channel about a mile wide, with 5 and 6 fathoms of water, west of the shoal, between it and an extensive mud flat bare at low-water springs.

Santa Clara River, about 10 miles from the low point fronting Direction Sandhill, is only navigable at high water; at low-water springs it is dry, with the exception of here and there a pool of water.

The sand hills and table-lands, which up to this point have run parallel with the coast, here assume a more northerly direction, following the course of the Santa Clara River.

Beacons.—Santa Clara Beacon, on the west side of the mouth of the river, consists of a couple of piles with a piece of board nailed across the top.

White Beacon, 5 miles 283° from Santa Clara Beacon, is of piles with a triangular cage, and stands on a shoal spit making off from the west side of the mouth of an extensive slough. On the opposite side of the slough, 400 yards 19° from White Beacon, is a beacon in the form of a cross. These two beacons serve as guides for entering the slough and for avoiding a shoal which extends a short distance off its mouth.

Port Isabel, now abandoned, is situated on the east bank of the slough about 2½ miles from its mouth, at the first good landing place, the shores below being of very soft mud. About 2 miles above Port Isabel is a place called Ship Yard, with a few frame buildings.

Philips Point, 25 miles northwestward of Shoal Point and about 1½ miles beyond White Beacon, may be regarded as the head of deepwater navigation in the Colorado River; above it the channel soon becomes very shallow and tortuous, and is obstructed by sand bars, some of which have at times not more than 2 feet of water over them.

The north shore of the river, from the mouth of the Santa Clara to Philips Point and for several miles beyond, is an almost level alluvial plain, subject to overflow at high spring tides.

The black beacon on Philips Point has disappeared and a temporary one has been put up in its place. None is really necessary, as the point itself is prominent and can be seen, except possibly at times of springs or floods.

Montague Island, lying abreast of Philips Point on the south side of the main channel, is a low flat island about 6 miles long, with a greatest width of 3 miles. It is covered with coarse grass and scattered driftwood and logs, the latter giving evidence that it is subject to overflow at the time of freshets.

The passage between the island and the west bank of the river may be used at high water by small vessels, but is entirely bare at low-water springs. Southward of the island, along the Lower California shore, a mud bank, bare at low-water springs, extends for nearly 9 miles.

Gore Island, 2 miles long, north and south, $\frac{3}{4}$ mile wide, and similar in character to Montague Island, lies $\frac{3}{4}$ mile eastward of the southern part of the latter, separated by a channel in which there is at all times over a fathom of water, excepting on a narrow bar 400 yards wide at the junction of the channel with the main channel opposite Philips Point, which is just bare at low-water springs. A mud bank, similar to that scuth of Montague Island, extends off to the southward and eastward from Gore Island.

Channel.—The main channel, through which 2½ fathoms may be carried at ordinary low water as far as Philips Point, lies close along the Sonora shore. About 3 miles eastward of Gore Island, between the mud bank extending off from it and another similar mud bank, 13 miles in length, which lies on the scuthwest side of the main channel, is a channel nearly a mile wide, through which 1½ fathoms may be carried; it joins the main channel nearly opposite the mouth of the slough.

The Colorado River is navigable for light-draft vessels as far as Colville, Nev., about 600 miles above Philips Point, the channel retaining an average width of nearly 4 mile the entire distance.

Directions.—To enter the Colorado River by the main channel: After passing Consag Rock steer so as to keep it bearing 185°, and when Direction Sandhill is made out about ahead steer for it on a bearing 4° until in about 5 fathoms, ½ mile from the shore, Shoal Point bearing 123°; then steer 300°, passing inside the sandy shoal off the point, until Direction Sandhill bears 92°, the shore being distant about a mile. From here follow the shore line at about the same distance, using the lead continuously, and when Santa Clara Beacon is made out steer for it until within ½ mile of it and about the same distance from the shore; then steer again 300° until Range Hill, 813 feet high, with conspicuous white cliffs, 24 miles west of Philips Point, is just open of the point, when the range will lead through in the deepest part of the channel.

When passing White Beacon, at the mouth of the slough, haul a little to the southward to avoid the shoal making off from it.

Anchorage.—The best anchorage is to the eastward of Philips Point, off the mouth of a small estero midway between the point and White Beacon, about 400 yards from the shore, in about 3½ fathoms at low-water springs, mud bottom.

Caution.—Too much reliance must not be placed on the foregoing directions, as the mud flats and shoals are subject to frequent changes and the beacons may be gone. A vessel should not trust to compass course, as the currents may sweep her a long way off the line. The lead must be kept continually going. A vessel should not enter the river on the ebb tide, but take advantage of the first of the flood; leaving the river she should start on the last of the ebb.

Tides.—High water, full and change, at Philips Point is at about 2h. 15m.; springs rise 25 to 30 feet, neaps from 16 to 20 feet. The time of high water is about one and three-quarters hours earlier at Shoal Point.

Position.—The observation spot at the black beacon on Philips Point is in latitude 31° 46′ 10″ .4 N., longitude 114° 43′ 30″ .8 W.

Currents.—The tidal currents run with great strength at full and change of the moon, sometimes as much as 6 knots per hour, and

there is no slack water. The influence of the tide is felt for about 40 miles up the river, a few miles above Heintzelmans Point. At a short distance above Philips Point the spring tide comes in with a bore or bank of water 4 feet high, extending in one huge breaker clear across the river, while the ebb is still running out.

The winds at the mouth of the river are mostly from the northward and in summer are very dry and hot.

Remarks.—The principal exports from the river are hemp, which grows wild in great abundance, argentiferious lead ores, and copper ores. The river trade is in the hands of the Colorado Steam Navigation Co. Their vessels draw about 1 foot of water when light and 2 feet when loaded.

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CHAPTER VI.

THE COAST OF MEXICO AND ADJACENT ISLANDS FROM THE MOUTH OF THE COLORADO RIVER TO CAPE CORRIENTES.

Remarks.—The coast of Mexico, from the mouth of the Colorado River to Cape Corrientes, bordering partly on the Gulf of California and partly on the Pacific Ocean, is for the most part low and sandy, although in many places the mountains approach it closely. The summits of the Sierra Madre and of the high mountain ranges branching off from it may be seen in the distant interior.

The Mexican States, Sonora, Sinaloa, and Jalisco, fronting on this stretch of coast, have together a population of 1,786,800. The climate is temperate and the interior of the country is fertile, but the principal sources of wealth are the numerous mines of gold and silver.

The islands off the coast are generally barren and uninhabited. Tiburon Island, in the upper part of the gulf, is inhabited by the Seris Tribe of Indians.

There are many anchorages along the coast and several ports, among which Guaymas, Mazatlan, and San Blas are the most important.

The depth of water on the east side of the Gulf of California is in general much less than on the west side.

Currents.—The information regarding the currents along this coast is rather meager and the statements somewhat contradictory. They probably depend almost entirely on the winds, southerly currents predominating.

Between Guaymas and Cape Corrientes, during the rainy season (May to November), they are strong and irregular. Northerly currents are frequently encountered at this season. Tide rips are often seen along the edges of the shoals that lie off the coast.

Coast.—From Shoal Point, the eastern point of entrance to the Colorado River, the coast trends about east-southeastward for a distance of 10 miles, and is generally low, with here and there a sand hill of moderate height. Shoal water extends offshore to distances increasing from ½ mile near Shoal Point to 2 miles at 10 miles to the eastward of it.

Adair Bay is a wide indentation, 10 miles deep, entirely open to the southward, and is not navigable for even the smallest coasters, being full of dangerous shifting shoals. Its western limit is 10 miles eastward of Shoal Point, and Rocky Bluff, the eastern limit, bears from the point 112° distant 35½ miles, the coast falling away 10 miles from a line drawn between the two limits. The shore of the bay is low and sandy, with occasional rocky patches. Opening into the northern part is a lagoon, with several sand spits at its entrance, dry at low water, projecting 2 or 3 miles into the bay. Low plains, with surface deposits of soda, extend far into the interior. Spring tides rise about 22 feet.

Pinacate Mountain, 4,235 feet high, rises about 19 miles north-eastward of Adair Bay, and is the last high mountain seen on this coast when coming from the southward.

Rocky Bluff is a bold rocky point of dark color, surmounted by a sharp hill 408 feet high. The land behind it is low and sandy. A conspicuous dark-colored solitary hill, 426 feet high, called Flat Hill, stands 4½ miles northeastward of the point.

A small bight on the northern side is shoal and partly dry at low-water springs, but on the western and southern face 5 and 6 fathoms will be found close-to, with no outlying dangers. Rocky Point, 5 miles east-southeastward of Rocky Bluff, is like the latter in general character. The hill surmounting it is 226 feet high.

Rocky Point Bay.—Between Rocky Bluff and Rocky Point the coast recedes somewhat, forming a small open bay, where anchorage may be had in from 5 to 7 fathoms of water, on a line between the two points, with shelter from the northwesterly winds. The shore of the bay is sandy and covered with bushes; shoal water makes off from it about ½ mile.

Georges Bay.—From Rocky Point the coast falls away to the eastward, for about 22 miles, and ther gradually assumes a southerly trend, forming a large open bay, known as Georges Bay.

The shores of the bay are low and sandy; behind them are plains reaching well inland to the foot of mountains.

Six miles eastward of Rocky Point is the entrance to a lagoon, into which small vessels may pass at high water; and from 9 to 10 miles farther east are some salt lagoons lying a short distance behind the beach and having no apparent communication with the waters of the bay.

Southeastward from these lagoons the water is sheal for from 1 to 3 miles offshore.

Georges Island, lying 23 miles 141° from Rocky Point and 7 miles offshore, is a barren rock, about 1,200 yards long, 600 wide, and, near the southeast extremity. 206 feet high. Some rocks above water and others awash extend a little over ½ mile from it, in a northwesterly direction.

This island is covered with guano, which has been worked to some extent. Immense numbers of sea fowl inhabit it, and a great many seals were seen along the rocky shore.

A fair anchorage, with protection from a southeast wind, may be found northward of the island, in 3½ fathoms water. Spring tides rise about 18 feet.

Shoal.—Four miles northeastward of Georges Island is an extensive and dangerous shoal, which makes off 3 miles from the western side of a low sandy point that projects from the southeastern shore of Georges Bay. There are from 3 to 6 feet of water over this shoal at low-water springs; between it and the island is a channel with from 4 to 7 fathoms.

Coast.—From abreast of Georges Island the coast trends nearly south for 20 miles and then gradually falls away to the eastward; as far as San Ignacio River, 31 miles from the island, it is low and sandy, with sand hills from 20 to 60 feet high; southward of the river it is higher, the hills approaching nearer the sea.

The soundings offshore increase gradually, the 3-fathom curve being from $\frac{1}{2}$ mile to $1\frac{1}{2}$ miles from the beach.

Shoal.—Seven miles 161° from Georges Island and 5 miles from the mainland, a shoal spot with from 4½ to 6 fathoms of water was passed over, there being 9 fathoms north and 8 fathoms south of it, at the same distance from the shore.

which the sea at times breaks heavily. The river, as it approaches the coast, loses itself in the sand during the dry season, only breaking through to the gulf during the rainy season. Near the south bank of the river, about a mile from the coast, are some Indian huts and a well; fresh water may be precured at all times just behind the sand hills. The banks of the river are covered with vegetation, and game is plentiful in the vicinity. The mouth of the river is readily distinguished by the break in the sand hills through which it passes to the gulf. The northern extremity of the coast range of mountains is just south of the river.

Cape Tepoca lies 17³ miles southeastward of the mouth of the San Ignacio River, the coast between them curving about 3 miles to the eastward; it is of reddish color, 300 feet high, and appears as an island when first seen from the northward.

Tepoca Bay.—From Cape Tepoca a low rocky point makes out to the southeastward about ½ mile, with a reef and a large rock partly covered at high water projecting from it about ¼ mile farther in the same direction. The point and reef form the western limit of Tepoca Bay, which is entirely open to the southward and about 2½ miles in extent, east and west. The northern shore of the bay is

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low and sandy, covered with bushes; the eastern shore consists of bluffs, with the coast range rising a short distance inland.

There is good anchorage in Tepoca Bay, sheltered from the north-westerly winds, in 5 or 6 fathoms at low water, $\frac{1}{2}$ mile from the shore. Spring tides rise about 15 feet, neaps about 12 feet.

Flat Peak, 1,575 feet high, bearing 60° from Cape Tepoca, 6½ miles distant, is an excellent guide to the anchorage in Tepoca Bay, when coming from the southward, as is Dark Mountain, which appears first as a dark-red flat-topped island and later as a bluff, with the greatest height to the westward. Tent Peak appears remarkably like Flat Peak when seen from the southward, both being square shouldered with a sharp peak in the center.

Coast.—From Tepoca Bay the coast trends nearly south to Cape Lobos, 23 miles distant. For about 10 miles sand cliffs from 25 to 50 feet high lie just behind the beach; thence to Cape Lobos the coast is generally low and sandy, the coast range approaching the shore. Lobos Peak, 3 miles north of Cape Lobos, is 1,186 feet high and somewhat less than 1 mile from the shore.

The entire distance from Cape Tepoca to Cape Lobos appears to be free from outlying dangers, the water shoaling gradually toward the shore.

Cape Lobos is a rocky headland similar to Cape Tepoca; near it are three hills, close together and parallel with the shore, the west-ernmost and highest 669, the middle one 580, and the easternmost 650 feet high. Vessels may approach the cape closely, 5 and 6 fathoms of water being found at 200 yards. Sunken rocks have been reported off the cape.

Libertad Anchorage.—At Cape Lobos the coast again turns sharply to the eastward for 3½ miles, when it takes a southeasterly trend. In the open bay or bight thus formed, known as Libertad Anchorage, a vessel will be well protected from the northwesterly winds, but exposed to the southeasters. The best place to anchor is from ¾ mile to a mile eastward of the cape and a scant ½ mile offshore, in 8 or 9 fathoms. The shore is a sandy beach with 3 fathoms of water close-to.

Two and a half miles eastward of the cape is a low projecting point from which a shelving rocky ledge and numerous detached rocks extend 400 yards in a southerly direction; behind this point are some houses, one of which is used as a customhouse.

Libertad is a shipping point for some of the agricultural and mineral products of Sonora.

Tides.—Springs rise 12 feet, neaps, 9 feet.

Coast.—From Cape Lobos to Cape Tepopa, a distance of 36½ miles, the coast consists chiefly of sand and shingle beaches, with occasional rocky bluffs intervening, back at a short distance by

the coast range, from 500 to 2,300 feet high. Eight and a half miles north of Cape Tepopa is a low slightly projecting point, off which a shoal with from $2\frac{1}{2}$ to 3 fathoms of water on its extends nearly $\frac{3}{4}$ mile. With this exception the coast is clear, the water shoaling gradually toward the shore, from 15 to 30 fathoms being found at a mile.

Northward of Cape Tepopa the curve in the coast line forms a sort of open bay, which, however, affords no protection whatever from the prevailing winds. The shore of this bay is low and sandy; from it, low plains covered with bushes stretch far inland.

Cape Tepopa is a bold rocky headland surmounted by Tepopa Peak, 1,857 feet high. This peak is the northernmost and highest of a small group of hills standing parallel with the coast and separated from the coast range, 5 miles to the eastward, by low sandy plains.

Sargents Point, 6½ miles southeastward of Cape Tepopa, is a barren rocky hill, 150 feet high, at the southern extremity of a low, narrow neck of land which is subject to partial overflow at highwater springs; between it and Cape Tepopa the coast is low.

West of the point is a small bight, where tolerable anchorage may be found in 7 fathoms of water, $\frac{1}{2}$ mile from the shore.

East of the point is a small bay, $2\frac{1}{2}$ miles wide, but with water too shoal to afford anchorage of any value. The beach is very flat, the low-water line being from $\frac{1}{2}$ mile to a mile outside that of high water. At the head of the bay is the outlet of a lagoon that lies parallel with the north shore, a narrow strip of sand intervening between it and the waters of the bay. Beyond the lagoon is the low sandy plain that lies between the group of hills near Cape Tepopa and the coast range.

The coast from Sargents Point to San Miguel Point, a distance of over 20 miles, has a southerly trend, and is for the greater part of the distance low and sandy, with a scattered growth of bushes.

Patos Island, the northwest point of which lies 53 miles 200° from Cape Tepopa, is small in extent, and low except on the northwest side, where it rises in a conical hill to a height of 274 feet. A deposit of guano gives it a whitish appearance.

The passage between Patos Island and the mainland, and that between Patos and Tiburon Islands, are perfectly safe, with a least depth of 7 fathoms, near the land.

Anchorage.—There is a tolerable anchorage on the south side of Patos Island, with some protection from a northwest wind, in 5 fathoms of water, sandy bottom, ‡ mile from the beach. In using this anchorage care should be taken not to approach nearer than ‡ mile the low shingle point that makes off from the southwest side of the island, as shoal water extends from it some distance.

Tides.—Springs rise 10 feet, neaps 7 feet.

Tiburon, the largest island in the Gulf of California, is about 29 29 miles long, nearly north and south, with an average width of 15 miles. It is high and rugged, with peaks from 1,000 to nearly 4,000 feet high. A narrow, intricate channel called El Infiernillo separates it from the mainland to the eastward.

During the greater part of the year Tiburon Island is the resort of the Seris Tribe of Indians, who inhabit the adjacent mainland and were formerly reputed to be hostile.

The northwest point of the island is a rocky bluff, surmounted by a steep hill 1,123 feet high, off which, at a short distance, lie some detached rocks; 5\frac{3}{4} miles to the eastward is a high bluff point, the northern extremity of the island, between which and Sargents Point is a channel 4.1 miles wide, with 7 and 8 fathoms of water.

Freshwater Bay, formed by a curve in the north coast of the island, affords an anchorage in from 5 to 7 fathoms of water, 3 mile from the shore, with shelter from southeasters, but entirely open to the northwest. The land slopes gradually from the bay toward the mountains in the interior and presents a fertile appearance.

The northeast point of the island is 3.4 miles eastward of the north extremity, and the same distance from the nearest mainland to the northeastward. A sandy islet, 5 feet high, lies in the prolongation of the point, connected with it by a shoal over which the water breaks. In the channel between the islet and the mainland, near the islet, are 3 and 4 fathoms of water.

The eastern side of the island from the northeast extremity to a low projecting point opposite San Miguel Point on the mainland, a distance of about 15 miles, with the exception of a short stretch of bluffs 10 to 20 feet high, is low, sandy, and covered with a scanty growth of bushes.

El Infiernillo, the channel separating Tiburon Island from the mainland, varies in width from 1 to 3 miles. The southern part, with from 5 to 7 fathems of water, is comparatively free from shoals, but the northern part is shallow and full of shoals and sand spits; it is unsafe for navigation except by the smallest vessels.

From the low point opposite San Miguel Point to the southeast extremity of the island, 13½ miles, the shore, for 8 miles, is low and sandy, with shoals and sand bars extending from ½ mile to 1¼ miles offshore; the remainder is steep, with rocky bluffs near the southeast point of the island, and deeper water near the shore, from 5 to 7 fathoms being found at ¼ mile.

The southeast point of the island is a high headland at the extremity of a peninsula, ½ mile wide, that projects a mile from the main body; on this peninsula are two hills, separated from each other by

a strip of lowland which forms a shallow basin for the reception of water during the rainy season. On the north side of the peninsula good anchorage will be found in 5 or 6 fathoms of water, sheltered from the prevailing winds; a sand beach at the inner end affords a landing place.

Monument Point, the southernmost point of Tiburon Island, is a rocky bluff point, $3\frac{3}{4}$ miles from the southeast extremity of the island. The intervening coast is a sand beach, and recedes $\frac{1}{2}$ mile within the two points.

Turners Island, a small barren island about 1½ miles in length, north and south, ½ mile wide, and 550 feet high, lies 1½ miles southeastward of Monument Point. A reef of rocks, both above and below water, projects ½ mile off from its northern end, leaving a narrow boat passage between it and Seal Rock.

Seal Rock, a rocky islet 150 feet high, between Turners Island and Monument Point, is surrounded by numerous outlying rocks, but between it and Monument Point is a clear channel, ‡ mile wide, through which 5 fathoms of water may be carried.

At 1,200 yards southwestward of Seal Rock there is a dangerous rock, awash at high water.

Red Bluff Point is a sharp rocky point of reddish color and about 150 feet high, 2½ miles westward of Monument Point.

Anchorage.—Between Monument and Red Bluff Points the coast recedes about $\frac{3}{4}$ mile, forming a small bay, open to the southward, in which good anchorage may be found, with shelter from the northwest winds, in 5 or 6 fathoms, $\frac{1}{4}$ mile from the shore, which is a sand beach. About midway of the bay is a slightly projecting rocky point with an arroyo just east of it. Tides rise 6 to 8 feet.

Willards Point, the southwest extremity of the island, is a bold cliff over 300 feet high, surmounted by a hill about 800 feet high. There is said to be a tolerable anchorage about 1½ miles eastward of it, in 7 fathoms of water, close to the shore.

At 3\frac{3}{4} miles eastward of Willards Point, 300 yards from the shore, there is a large detached white rock 30 feet high.

The western shore of the island, from Willards Point to the northwestern extremity, a distance of 21 miles, is for the most part steep, with rocky bluffs, the mountains rising abruptly just behind the coast; the greater part is clear of dangers, with deep water close-to. A mile and a half northward of Willards Point and less than 200 yards offshore there is a detached rock 8 feet high, and 11½ miles farther north a simliar rock; near the northwest extremity of the island are a number of outlying rocks close to the shore.

San Esteban, a barren rocky island, lying 74 miles south of the southwest end of Tiburon, is 4 miles long, north and south, about 3 miles wide, and from 1,000 to 1,800 feet high. On its eastern side,

a mile from the southeast point, is a rock 25 feet high, ½ mile from the shore and connected therewith by a rocky reef. Just north of this rock and reef is a gravel beach from which a valley slopes toward the interior of the island. From the southwest end of the island a low shingle spit makes off ¾ mile, the soundings on either side of it increasing rapidly. The remaining shores of the island consist of almost perpendicular bluffs, varying in height from 100 to 500 feet, with short stretches of gravel and shingle beach intervening.

Channels.—The channel between San Esteban and Tiburon on the north, 6 miles wide, and that between San Esteban and San Lorenzo on the west, 10 miles wide, are free from dangers, with depths of over 100 fathoms.

Shoal.—A 15-fathom shoal, soft mud bottom, has been reported about 19 miles south of Monument Point. The bank was developed over an area 3 miles square, the depths ranging from 15 to 23 fathoms. Two miles westward of the developed area the bottom dropped suddenly to no bottom at 80 and 100 fathoms. The full extent of the bank has not yet been determined.

San Miguel Point, on the Sonora Coast, is low, sandy, and covered with bushes. Half a mile northward of the point is a small lagoon with shoal water off its mouth. A shoal with 3 fathoms of water at its outer edge makes off 3 mile from the south side of the point. For a distance of 4 miles the coast is low and sandy, then follow steep bluffs terminating in Dark Bluff, 175 feet high, behind which, a short distance inland, a sharp peak rises to a height of 1,480 feet. After passing Dark Bluff the coast becomes low again.

Kino Point, 17³ miles southeastward of San Miguel Point, is a prominent point of moderate elevation, with a group of hills a short distance behind it, the highest of which is 1,336 feet high.

The soundings between Kino Point and Tiburon are very regular, but show comparatively shoal water, 14 fathoms being the greatest depth obtained.

Kino Bay, just north of the point, is shoal throughout the greater part of its extent, but small vessels may anchor in it and find shelter from the prevailing winds. Tides rise about 6 feet.

Pelican Island, in the northern part of Kino Bay, 3 miles from Kino Point and a little over a mile from the coast, is 540 feet high, but of small extent; its shores are low and sandy with the exception of the southwestern face, which is of rocky bluffs; in its northern part is a small lagoon. The channel between the island and the mainland has a greatest depth of 13 fathoms.

La Cruz Lagoon, which has several branches spreading out through a low, flat ccuntry, opens into the head of Kino Bay. The entrance, which is ½ mile wide, has a greatest depth of 2 fathoms,

but a bar extending off from it a short distance has on it only $1\frac{1}{2}$ fathoms.

The Sonora River, which rises near the southern boundary of Arizona and with its tributaries drains the greater part of the State of Sonora, divides near the coast into several branches, which disappear in the low country surrounding La Cruz Lagoon. Hermosillo, the capital of Sonora, is situated on this river. The Rio de la Poza, which divides like the Sonora and disappears in the San Juan Bautista Flats during the dry season, overflows them in the wet season, carying vast quantities of sand into the gulf and creating extensive shoals along this part of the coast.

Shoal.—At 22½ miles southeastward of Kino Point a low sandy point projects over a mile from the general coast line, and a sandy shoal, with 3 fathoms of water on its outer edge, extends over 3½ miles off the point to the southwestward.

Caution.—Care should be taken to give this shoal a good berth, as appearances indicate that it is extending to the southwest and the west. Only 5 fathoms of water are found 13 miles westward of the low sand point.

The Estero de Tastiota opens on the coast 35 miles southeastward of Kino Point, and has a narrow entrance through which only 3 feet of water can be carried at high tide; the estero expands within to a considerable size, trending to the northward, a range of hills rising behind it. Fresh water may be obtained near the head. Outside the entrance shoal water extends about a mile offshore.

Anchorage may be had in good weather off the mouth of the Estero de Tastiota in 6 or 7 fathoms of water, $\frac{1}{2}$ mile from shore.

Morro Colorado, a remarkable headland of reddish color, 758 feet high, is a little less than 5 miles southeastward of the entrance to the Estero de Tastiota, the intermediate coast consisting of steep bluffs from 50 to 75 feet high, with a number of outlying rocks. Hills rise immediately behind the coast.

From Morro Colorado to San Pedro Point, a distance of 17½ miles, the coast is high and barren, rugged bluff points from 300 to 500 feet high alternating with short steep stretches of sand beach. Throughout the entire distance there is no shelter from the prevailing winds nor any safe anchorage. A number of detached rocks awash and others above water lie off this part of the coast.

Las Piedras Blancas are three white rocks, one 60 feet high and the other two 15 feet high. The largest of these rocks lies 7 miles southeastward of Morro Colorado and a little over $\frac{3}{4}$ mile from the shore; the other two lie on either side of the largest, one northward, the other southward, at $1\frac{1}{4}$ to $1\frac{1}{2}$ miles.

Another group, consisting of four rocks varying in height from 15 to 100 feet, lies between 3 and 4 miles northward of San Pedro Point and less than 4 mile from the shore.

San Pedro Point is a bold rocky headland 525 feet high.

San Pedro Bay is a small cove southeastward of the point. The entrance, $\frac{3}{8}$ mile wide, between two steep rocky heads, has a depth of from 5 to 8 fathoms. The head of the bay, somewhat less than $\frac{1}{2}$ mile from the entrance, is a sand beach with a range of hills behind it. The soundings decrease gradually toward the shore. Tides rise about 5 feet.

Anchorage will be found about midway of the entrance, in from 5 to 6 fathoms of water, with shelter from the northwest winds.

San Pedro Nolasco Island, a barren rock of volcanic origin lying 8½ miles southwestward of San Pedro Point, is 2½ miles in length parallel with the coast, ¾ mile wide in the middle, and varies in height from 500 to 1,071 feet. On the southeast side is a place where a landing may be effected; in all other parts it is inaccessible. Some deposits of guano are said to exist on it. Off the southern end are some outlying rocks close-to, elsewhere the water is deep close to the bluffs. Soundings of 35 and 40 fathoms were obtained along the eastern side, 200 yards offshore.

The coast southeastward of San Pedro Point has the same rugged character for a distance of 51 miles, as far as Point San Eduardo, which is a rocky bluff point 60 feet high, the land behind it sloping upward to a mountain, 21 miles distant and 2,422 feet high, known as Algodones.

Three-quarters of a mile southeastward of Point San Eduardo and close to the shore is a small islet or rock, 40 feet high, with a rock awash just outside of it.

Between Point San Eduardo and Point San Antonio, a distance of 5½ miles, the coast is low and generally sandy. Southward of Algodones Mountain, close to its foot and ½ mile from the beach, is a ranch with considerable cultivated ground in the vicinity and tresh water.

The Algodones are three small islands lying about 1½ miles northwestward of Point San Antonio and extending about a mile in a direction nearly at a right angle with the coast.

Venado, the outermost and largest of the three, is steep and rocky, a little over 200 yards wide, and about 150 feet high; about 800 yards east of its southwest extremity lies a solitary rock 5 feet above water.

San Luis, the second in size, is about 30 feet high, with a passage less than 150 yards wide between it and the mainland. At 200 yards northward of the northeast end of San Luis is the entrance to a small lagoon.

Doble, the smallest of the three islands, lies between the other two, at less than 100 yards from either.

Point San Antonio is low and rocky, the hills behind it rising to a moderate height. On its northwest side, close-to, is an outlying rock 30 feet high.

Along this part of the coast the soundings show deep water close to the shore, 23 fathoms being found within $\frac{1}{2}$ mile of the point, increasing to over 100 fathoms at $3\frac{1}{2}$ miles.

From Point San Antonio the coast for 2½ miles is of rocky formation, with many outlying rocks both above and below water.

Las Tetas de Cabra are two remarkable peaks, 1,633 feet high, about $\frac{1}{2}$ mile eastward of Point San Antonio and less than $\frac{1}{2}$ mile from the beach. They resemble, as their name implies, a goat's teats, and are a valuable landmark in making the port of Guaymas.

Point Doble, 2½ miles east of Point San Antonio, is the southern extremity, 50 feet high, of a headland from 200 to 300 feet high, with an average width of 300 yards, which projects southward from the general coast line nearly a mile.

On the west side of the headland, where it joins the coast, is a small open bay with a sandy shore, known as the Ensenada de las Tetas.

Point San Guillermo is a rocky point projecting from the east side of the Doble Headland. A number of detached rocks lie off the point, and about halfway between it and Point Doble is a rock 150 feet high, known as Santa Catalina Island.

Point Paredones is a bluff point at the eastern side of the entrance to Puerto San Carlos. The extremity of the point is 600 yards north of Point San Guillermo and 300 yards east of the nearest part of the Doble Headland.

Puerto San Carlos is a small landlocked harbor, which affords to small vessels an excellent anchorage with perfect shelter. The entrance is only 200 yards wide at its narrowest point, with from 4 to 8 fathoms of water. The harbor is $\frac{7}{10}$ miles long and $\frac{1}{4}$ mile wide, the water shoaling gradually toward its head, 3 fathoms being found 800 yards within the entrance.

San Nicolas Island, a small islet about 50 feet high and surrounded by detached rocks, lies a scant ½ mile eastward of Point San Guillermo and about the same distance from the nearest land to the northward. In the channel between it and Point San Guillermo are from 9 to 11 fathoms of water.

The passage between the island and the mainland to the northward is considered dangerous, being full of rocks and islets.

Point de las Cuevas, a long narrow bluff point, is $\frac{1}{2}$ mile eastward of Point Paredones and nearly $\frac{1}{2}$ mile from the north end of San Nicholas Island.

Ensenada de San Francisco is a large open bay formed by a sweep to the northward of the coast line east of Point de las Cuevas. The northwestern shore of the ensenada is hilly; the northern shore is low and sandy, the lowland extending well into the interior; the eastern shore is mostly rocky, with bluffs backed by highland.

An extensive lagoon, the Estero Soldado, opens into the northeastern part of the bay, and within its limits are several islets and rocks. Just south of the entrance a reef of rocks projects nearly ½ mile to the southeastward.

Chapetona, in the northwestern part of the Ensenada de San Francisco, is a barren islet about ‡ mile long and 40 feet high, with steep bluffy shores and numerous outlying rocks.

Medio and Candelero Islands, in the eastern part of the ensenada, are respectively 20 and 35 feet high. About 200 yards north of Medio is a detached rock 40 feet high; and about the same distance north of Candelero is one 8 feet high, between which and Medio is a channel nearly ½ mile wide and apparently free from danger. All three islands of the ensenada are surrounded by outlying rocks close-to.

Ensenada Bocochibampo is an open bay a little more than a mile long and wide, at the southeastern limit of Ensenada de San Francisco. There are from 8 to 10 fathoms of water at the entrance, the depth decreasing rapidly toward the head. Just behind the eastern shore of the bay is a shallow lagoon, into which only boats can enter, and at its northeastern end a small settlement. The city of Guaymas lies about 3 miles east of the head of the bay.

Good anchorage may be had in 4 or 5 fathoms, $\frac{1}{2}$ mile from the beach in the northeastern part of the bay.

A radio station is located at Bocochibampo.

Supplies.—Fresh water, fresh beef, fruit. etc., may be obtained.

Cerro Bocochibampo, a double-peaked mountain, 1,643 feet high, stands about a mile north of the ensenada and about the same distance from the coast.

Point Colorada, the southern limit of Ensenada Bocochibampo, is a prominent headland 60 feet high, connected with the mainland by a low strip of sand beach; off its southern side are numerous detached rocks.

Blanca Island, lying about 300 yards northwest of Point Colorada, is about 230 yards long and 100 feet high.

Cape Arco, 2½ miles south-southeastward of Point Colorada, is a high rocky bluff, with a hill 862 feet high rising abruptly behind it. About midway between the points and ‡ mile from the nearest shore is a solitary rock 30 feet high.

Lobos Island is a large rock 125 feet high, lying 400 yards north-westward of Cape Arco and close to the shore. From 600 to 1,000

yards northward of Lobos Island, a short distance offshore, is a group of rocks, some of which are from 30 to 40 feet high.

Mesquite Point, 250 feet high, is a little more than 14 miles eastward of Cape Arco.

Ensenada Carisel, a deep bight between Cape Arco and Mesquite Point, is entirely open to the southward and has a short strip of sand beach at the extreme head. Part of the northern shore is of rocky bluffs, with outlying rocks.

San Rafael Point is a rocky bluff point about midway between Mesquite Point and Cape Haro. Mount San Rafael, 1,200 feet high, bears from it 25° distant about a mile.

Cape Haro, the southern extremity of the long irregular peninsula upon which Guaymas is situated, is a prominent rocky headland surmounted on its western end by a bold hill 295 feet high, and may be closely approached, upward of 20 fathoms of water being found within 200 yards of it.

Cape Haro Light.—A fixed and flashing white light, showing a flash every 60 seconds, visible in clear weather 26 miles, is exhibited at an elevation of 345 feet above the sea from a red conical framework tower, 26 feet high, on the southeast extremity of the eastern part of the cape. There is also a keeper's dwelling. See Light List.

Point Narisson, the first prominent point northward of Cape Haro and 1,000 yards distant, is composed of high rocky bluffs. Narisson Peak, 900 feet high, is west of the point and about $\frac{2}{10}$ mile from the shore.

Catalina Bay, a small cove, opens to the eastward between Maria and Ventana Points, a little more than ½ mile north of Point Narisson. The soundings in the bay are regular, decreasing from 8 and 10 fathoms at the entrance to 3 fathoms near the head.

San Vicente Island, forming the western entrance point of the harbor of Guaymas, is separated from Paz Point on the mainland by a channel 100 yards wide, through which 2½ fathoms of water may be carried.

Pitahaya Island, lying 200 yards north of Paz Point, is high, rocky, and of small extent, with from 2 to 3 fathoms of water between it and the point, but only \(^2\) fathom between it and the mainland. West of Pitahaya a small stream empties into the bay. It is said that fresh water may be obtained a short distance up this stream.

Pajaros, a long rocky island, the highest point of which is 212 feet high, forms the eastern entrance point of Guaymas Harbor, the channel between it and San Vicente being 1,600 yards wide, with 6 fathoms of water. From the southwest and northeast ends of the island rocky reefs make off a short distance to the northward.

Pajaros Island Lighthouse, on the southwestern extremity of the island, is a white skeleton tower exhibiting a group occulting

white light, visible 14 miles, at a height of 75 feet. There is a white dwelling with red roof at the base.

Baja Point lies about $\frac{7}{8}$ mile northwestward of the southwest end of Pajaros Island, the channel between them having a depth of from $5\frac{1}{2}$ to 7 fathoms. It is a rocky bluff point with some outlying rocks close-to; behind it the land rises gradually.

Morro Ingles, a solitary rocky hill at the western extremity of a long, low, narrow strip of sand beach, known as the Playa de las Dolores, bears 11° from Baja Point, distant $\frac{3}{4}$ mile, the navigable channel between them being $\frac{1}{2}$ mile wide, with a depth of from 3 fathoms near the shore on either side to $5\frac{1}{2}$ and 6 fathoms in the middle. A shoal, partly bare at low water, extends 600 yards westward from the Morro Ingles.

Between Parajos Island and the Playa de las Dolores is a passage, through which 12 feet can be carried.

Guaymas Harbor, the largest and most important in the Gulf of California, consists of an outer harbor, situated between Pajaros Island and the mainland, for vessels over 25 feet draft; a middle harbor, included between Baja Point on the south, Morro Ingles on the east, and the islands of Almagre Grande and Ardilla on the west, for vessels of 16 to 25 feet draft; and an inner harbor for vessels of not over 16 feet draft; all well protected.

Anchorage.—The best anchorage for moderate draft vessels is about on a line between the highest points of Almagre Grande and Morro Ingles, in 3½ to 4 fathoms of water, good holding ground, with protection from every wind. Vessels of less than 15 feet draft may pass between Almagre Grande and Ardilla and anchor in 2½ to 2¾ fathoms, ½ mile from the landing place. Vessels of over 25 feet draft should anchor between Pajarcs Island and Baja Point, in 6 fathoms of water.

Tides.—High water, full and change, is at 8h.; springs rise about 4 feet.

Directions.—Cape Haro is probably the best landmark for making Guaymas. Coming from the northward, Las Tetas de Cabra are said to offer a god mark, but from the southward they can not be made out until close up to Cape Haro, on account of the high land behind them.

It is advisable to make the land to windward of Cape Haro (the prevailing wind being from the northwestward, keeping it under the lee until close in, when it may be rounded close-to, deep water extending close up to the rocks. Steer then for the entrance between San Vicente and Pajaros Islands, which will be readily distinguished, giving the points of these islands a berth of 200 yards. After passing Baja Point, being in about 6 fathoms of water, steer for the fort on the eastern end of Ardilla Island, and anchor as convenient.

The lead is a safe guide in entering, and should be kept going after passing the southwestern end of Pajaros Island to avoid getting into the shoal water on the east side of the channel; with a leading wind this shoal may be easily avoided by keeping well over toward Baja Point. In beating in, care must also be taken to avoid the shoal, which partly uncovers at low water, lying off Morro Ingles; to do this the fort on the east end of Ardilla must not be brought to bear anything to the westward of 303°, or the cemetery in the eastern outskirts of the town opened eastward of the fort.

To enter the inner harbor, if with a leading wind or in a steamer, steer from the outer anchorage toward the highest part of Ardilla until on a line between Morro Ingles and the white fort on Cantara Point; then steer for the latter, passing between Almagre Grande and Ardilla, and when clear of the islands haul up for the center of the town and stand in as far as the vessel's draft will permit; the soundings decrease regularly from the passage between the islands toward the shore. With a head wind the eye and lead are safe guides, care being taken not to approach the shores of the islands too closely.

The fort on Cantara Point and that on Ardilla Island are in ruins.

Guaymas, situated at the head of a small bay on the northwestern side of the inner harbor, is surrounded by high mountains, and is extremely hot in the rainy season. The general health of the city is good; there is comparatively little malaria and typhoid. There is a regularly appointed sanitary commission, a military and civil hospital, neither of which are said to be well equipped. The Yaqui Indians occupy one section of the city. They are very intelligent and possess considerable mechanical ingenuity, being experts in saddlery and the manufacture of straw goods; their earthenware is of good quality, and the serapes (shawls) which they weave by hand are much admired for beauty and fineness of texture.

Within the city are a number of fine structures of the architecture peculiar to the country, and a few of the American style.

The United States is represented by a consular agent.

The climate in the vicinity of Guaymas from November to April is pleasant, the temperature ranging from 74° to 80°. During the summer months, from June to October, the mercury reaches 105° to 110° and seldom falls below 97° or 98°. When the heat winds visit the town, as they often do in the summer months, the temperatures frequently reaches 135°. In September, which is the hottest month of the year, all foreigners ashore leave the coast, if possible.

From October until June there is very little or no rain and rarely anything in the way of storms. But from June until September many of the days are sultry and oppressive, and during these months

occur the rains which are very frequent. In July, August, and September occur the "chubascos." These storms usually occur after a very hot, oppressive day and are preceded by frequent lightning around the horizon, accompanied with a slight rise of the barometer. It has not been known to occur during the daytime, but always at night, at almost any time between 8 p. m. and 4 a. m. Just preceding one of these squalls the sky may be perfectly clear overhead with calm or light breezes; around the horizon low, dark clouds, and the lightning is if anything more frequent and vivid than usual. Within 15 minutes after such conditions it may be blowing a gale of force 7, with heavy rain and accompanied by a rough sea. Storms of this character last only in full force for about one-half hour, and the direction of the wind shifts round to various points of the compass. Heavier storms lasting several days occur in October.

Fog prevails occasionally, but it is usually of short duration, seldom over eight hours.

In the Gulf of California and in the vicinity of Guaymas, mirage is quite common, and instances of peculiar refraction have been reported.

Supplies.—Fresh water can be obtained from the local water company, delivered alongside in barges. Excellent flour, fresh bread, veal, pork, and beef can be obtained in any quantity at moderate prices. Good oysters from the Yaqui River are found in the market at the proper season. No salt provisions or ship's stores can be purchased.

Coal.—There is no coal for sale by dealers. The Southern Pacific Railroad Co. maintains a supply for its own use which it will sell to naval vessels.

The exports are wheat, corn, flour, cotton, tobacco, unrefined sugar, aguardiente, dried beef, hides, gold, silver, copper, and phosphate of lime.

The imports are principally provisions, manufactured goods, and machinery.

Officials.—The officials to be called upon are the captain of the port, the administrator of customs, the officer commanding the dock-yard, and the officer commanding the troops in this district. Guaymas is not a saluting port.

Pilotage.—Pilotage is compulsory, but not necessary. The pilot signal station is at Cape Haro.

Boat landing.—The landing place for small boats is at the wharf in front of the town.

Docking and repairing facilities.—The Mexican Government has a marine railway and small repair plant on the peninsula on the point to the north of Point Baja. At present (December, 1912) this railway has a capacity for vessels of 2,000 tons, but it is stated

that this capacity is being increased and within a few months will be made 3,000 and later on still further increased. The repair shops in connection with this dock are capable of handling ordinary repairs to vessels and their machinery. The Southern Pacific Railroad Co. maintains a good machine shop and appurtenances at their station about 4 miles out of the town where most work needed by ships could be done.

Communications.—The Southern Pacific Railroad Co. maintains a daily train service north and south. The steamers of the Naviera Mexicana Line maintain a semimonthly service. The Navigacion del Pacifico maintains a semimonthly service, and small steamers operate to the neighboring small ports and across the gulf. There is a Mexican Federal telegraph office, also the radio station before mentioned.

The Southern Pacific Railway enters Guaymas by a trestle over La Laguna at Blanca Point. The passenger station is at the base of Lastre Point, and the railway shops, roundhouse, etc., are on Arena Point. A trestle connects Arena Point with the west end of Ardilla Island, and a wharf and a bonded warehouse have been built at the southwest point of the island. The wharf is 90 feet wide and extends 280 feet south from high-water mark; the end of the wharf is in about 17 feet at low water.

Mails.—There is a daily mail with the United States by rail and a monthly mail by sea to San Francisco, as well as one every week to the coast ports south.

La Laguna, an extensive sheet of water lying northward of the Playa de las Dolores, and opening from the outer anchorage of Guaymas, has an average depth of 2 fathoms in its southern part; the northern part is full of shoals and sand bars, a narrow channel, with from 6 to 8 feet of water, extending as far as Blanca Point, 2½ miles nearly north of Morro Ingles. From Blanca Point a sand spit extends to the eastward ½ mile, nearly joining one making off the same distance from the opposite shore, the channel between them being less than 100 yards wide. Northward of this, La Laguna, with the exception of a few narrow boat channels, is dry at lowwater springs. A fresh-water stream, known as the Estero del Rancho, empties into La Laguna a short distance northwestward of Blanca Point.

San Jose de Guaymas, lying on both sides of the Estero del Rancho, 1½ miles from its mouth, is inhabited by civilized Indians of the Yaqui tribe. The country in the vicinity and far into the interior is level and sandy.

Coast.—From Morro Ingles the coast trends nearly east for a distance of 12 miles, to another conical hill, 379 feet high, known as Cerro Yacicoris, on the western side of the entrance to Viejo

Yaqui River. This part of the coast, which is a smooth sand beach, is called El Cochore.

Two and a quarter miles east of Morro Ingles, separated from the waters of the gulf by a narrow strip of sand beach, is a small lagoon, called Estero Cochore, with an opening into La Laguna. Three and a half miles farther east is a deserted village in a conspicuous grove of palm trees close to the beach. Still farther east is a bluff point, with a conspicuous point a short distance behind it, known as Cerro Tordillo.

Soundings obtained off this part of the coast show a less depth of water than is given on charts made from former surveys. Four and 5 fathoms only were found in places where the charts gave 6 and 7 fathoms. This would seem to indicate that the mud and sand brought down by freshets in the streams of this vicinity are deposited in the outer bay of Guaymas, and not carried off by the coast currents.

Viejo Yaqui.—Eastward of Cerro Yacicoris is a deep indentation in the coast line filled with shoals and sand bars, and navigable only for boats. The river entering the head, known as Viejo Yaqui, takes its rise in the Sierra Yaqui; it is dry during the greater part of the year. Bacatete Mountain, a conspicuous peak of the Sierra Yaqui, stands 17½ miles 62° from Cerro Yacicoris.

Coast.—From Cerro Yacicoris to Lobos Point, a distance of 31 miles, the coast trends nearly south and is low and sandy, being merely a strip of sand separating the waters of the gulf from the numerous lagoons that lie behind it. None of these lagoons is navigable except by boats, or vessels drawing less than 6 feet of water. Sandy shoals extend off this part of the coast from ½ mile to 1½ miles, with not more than 3 fathoms of water on their outer edge.

The Yaqui River is the largest stream in the State of Sonora, and is indeed the only one deserving the name of river. It rises in the mountains near the Arizona boundary, and flowing in a southerly direction empties into the Gulf of California about midway between Cape Haro and Lobos Point. The mouth of the river is filled with shoals and sand bars, and in the dry season is navigable by only the smallest coasters. It has three outlets which from a short distance appear like lagoons. A sand bank over 2 miles long and from \(\frac{1}{2}\) mile wide, over which the sea breaks, extends across the mouth, leaving passages at either end between it and the shoals. The banks of the Yaqui, for some distance from the coast, are inhabited by the tribe of Yaqui Indians.

There are said to be extensive fields of an excellent quality of coal on both sides the Upper Yaqui, which may give it some importance in the future.

Baroyeca Mountain, 50 miles 95° from the center of the sand bar off the entrance to the Yaqui River, is 3,298 feet high and affords a good landmark.

Lobos Point, the northwestern extremity of Lobos Island, is low and sandy, with a dangerous shoal making off nearly $2\frac{1}{2}$ miles to the northwestward. At the outer edge of this shoal from 5 to 7 fathoms of water were found, the soundings increasing within less than $\frac{1}{10}$ mile to 95 fathoms and over; bottom of fine dark sand. Southward of the point vessels may anchor in good weather, in 6 fathoms, $\frac{1}{2}$ mile from the shore. Tides rise about 4 feet.

Lobos Island is low and sandy, 4½ miles long and about 1½ miles wide. It is separated from the mainland by the Estero de la Luna which opens to the gulf at each end of the island. The highest part of the island is Monte Verde, a remarkable green mound 75 feet high, about 1½ miles eastward of Lobos Point.

Lobos Island Lighthouse, on the northwest point of the island, is an iron tower painted red and white in horizontal bands, with a red concrete house at the base. The light is flashing white, visible 14 miles. This light was reported unreliable in 1916.

Currents; fogs.—Strong currents, variable in direction, are often encountered in this vicinity, and fogs are of frequent occurrence.

Coast.—The coast from Lobos Point to the northwestern end of Ciaris Island, a distance of about 43 miles, has the same general character as above the point, being low, sandy, covered with bushes, and cut up by lagoons, off the entrances to which shoal water extends from 1 to 2 miles. The soundings 3 miles offshore show a depth of from 6 to 10 fathoms.

About midway between Lobos and Ciaris Islands is the former mouth of the Mayo River, now Viejo Mayo, off which is a bar over which the sea breaks.

Eight miles northwestward of Ciaris Island and about a mile off the entrance to a lagoon is a small island 3 feet above water. At this point shoal water extends over 2 miles offshore.

Ciaris Island is low and sandy like Lobos Island, a little over 12 miles long, parallel with the coast, and from ½ mile to a mile wide. It is separated from the mainland by a narrow estero of the same name, the entrance to which, at the northwest end of the island, is over 1½ miles wide, but shoal, with heavy breakers right across it.

Immediately west of the northwest point of Ciaris is a low sand islet a mile long and about 2 feet above water. A shoal makes out from it to the westward over 1½ miles.

Anchorage.—Vessels may anchor in fine weather anywhere along the coast between Lobos Point and Ciaris Island, taking care not to approach the land within 3 miles, or to get into less than 6 fathoms of water. Tides rise about 4 feet.

Alamos Peak is a conspicuous sharp mountain, 5,877 feet high, bearing 92°, 51 miles distant, from the north point of Ciaris Island.

Arboleda Point, 13½ miles southward of the northwest point of Ciaris Island, is an indefinite rounding point at the south end of an island 2¾ miles long and nearly a mile wide, separated from the mainland by the continuation of Ciaris Estero. Some clumps of scrubby trees on this land serve as an excellent landmark for the coasters, being the only ones in the vicinity.

Coast.—From Arboleda Point the coast trends southeastward about 11 miles to Rosa Point, and is a bare sand beach with a few bushes, and behind the beach a series of yellowish sand hills from 50 to 85 feet high.

Four and a half miles southeastward of Arboleda Point is the narrow entrance to the Estero de Santa Lugada, a lagoon of considerable extent. There is a bar with very shoal water at the entrance.

Resa Point is a low reddish point.

Santa Barbara Bay, the bight just east of Rosa Point, affords an excellent anchorage in northwest winds, but is entirely open to southeasters. The best anchorage is about a mile east of the point and the same distance offshore, in about 7 or 8 fathoms of water. Tides rise about 4 feet.

The country near the bay is well watered, fertile, and quite thickly populated. In the vicinity are several fresh-water lakes or ponds, and a small stream empties into the bay. Game is very abundant; large numbers of deer, rabbits, wild geese, and ducks were seen. The Indian villages of Vacamora and Santa Cruz, the latter on the right bank of the Mayo River, lie about 4 miles north of the shore of the bay. A customhouse has been established in the bay.

Santa Barbara is in telegraphic communication with Mazatlan.

Mayo River.—The mouth of this river, about 9½ miles east of Rosa Point, like the mouths of all the rivers on this coast, is closed by a bar, leaving a narrow channel on the eastern side through which 2 fathoms may be carried in the dry season. The entrance, which is a mile wide, may be recognized by a bare sand mound, 85 feet high, on its western side, and a mound 75 feet high, with some vegetation, on the eastern side. Shoal water extends off it nearly 2 miles.

Just within the entrance, on the eastern side, is a snug little cove where small vessels may anchor in 3 fathoms of water, well sheltered from every wind.

Coest.—From the eastern entrance point of Mayo River the coast trends about east-southeastward for 9 miles, to an Indian village near the shore; thence to the main entrance to the Estero de Agiabampo, a distance of 16 miles, it trends nearly south, and for the

entire distance is low, sandy, covered with bushes, and cut up by lagoons. Mountain ranges rise from 15 to 18 miles behind the coast.

The Estero de Agiabampo is an extensive lagoon, the entrance to which is narrow and intricate, being obstructed by shoals and sand bars, which extend about a mile off from the general coast line. The least depth found in the channel at low water was 2 fathoms; on either side were shoal patches, with from 3 to 5 feet of water, over which the sea broke heavily. On the south entrance point is a sand hill, 75 feet high, on the top of which is a wooden cross that serves as a mark for entering.

The bar and channels are undoubtedly subject to change, and the greatest care is necessary in entering. The steamer lines maintain buoys at the bar and in the bay, but strangers should take a pilot, not trusting too much, however, either to buoys or pilot.

Estero de Agiabampo Lighthouse, a white wooden tower with a hut at the base, is 340 yards 213° from Cruz Hill, and exhibits an occulting white light visible 10 miles.

Agiabampo, situated on the north shore of the estero, about 104 miles from the bar, is a place of some importance, being the seaport of the cities of Alamo, 40 miles distant, and Fuerte, 45 miles distant, with both of which it is connected by roads. It has a customhouse and exports silver ore and dyewood.

Communications.—A steamer of the Compañia de Navigacion del Pacifico, makes trips between Agiabampo, Altata, and Mazatlan. A Luis Martinez steamer runs from Guaymas to Agiabampo, Altata, and Mazatlan.

Anchorage and remarks.—The estero is difficult to find, as the coast is one long line of low sand hills, covered with bushes. Mount Alamos to the north, and Alligator Hill to the south, are the best guides to it. The best anchorage outside the estero is in 7 fathoms, 13 miles offshore, the lighthouse bearing 96°. The best time for boats to enter is in the morning, before or with the first of the sea breeze. Schooners of 50 to 100 tons go in and out with the land and sea breezes.

Tides.—Tides rise about 4 feet. The tidal streams are not felt in the offing, but on the bar have a velocity of 2 to 3 knots.

The coast from Agiabampo estero to the outer edge of the shoal off the mouth of Rio del Fuerte, a distance of 22½ miles, is similar in character to that north of Agiabampo, being low and sandy, and that part of it lying south of the Alamos River cut up by lagcons.

Alamos River.—The mouth of the Alamos River, which is narrow and has shoal water extending off from it \(\frac{1}{2}\) mile, lies $10\frac{1}{2}$ miles southward of the lighthouse on the south side of the entrance to the Agiabampo estero. It is navigable for only the smallest coasters. The sea breaks almost continually over the bar at the mouth.

Rio del Fuerte or Santa Maria de Ahome River forms part of the boundary line between the States of Sonora and Sinaloa. The entrance, with a bar extending across it, lies 12 miles southward of the mouth of the Alamos.

Fronting the mouth of the river is a sand island a mile long and ½ mile wide, and at either end a shallow channel leads into the river, navigable by only the small coasters. Two or three miles up the river, on either bank, are thick clumps of green trees and bushes. The village of Ahome is on the left bank of the river, about 10 miles from its mouth, and the town of El Fuerte, about 75 miles from the mouth of the river, in an important mining region.

During the rainy season the river is swollen considerably, and large quantities of dyewood are floated down in rafts or on flatboats.

Ahome Point, the north point of entrance to the river, is a low sand point projecting over a mile from the general coast line. An extensive shoal, over which the sea breaks, extends off from it in all directions from a mile to 11 miles.

Alligator Hill, a remarkable flat-topped hill, 413 feet high, standing 6 miles 45° from Ahome Point, is a good landmark.

Eastward of Alligator Hill and about 18 miles from the coast is the Sierra de San Pablo, 2,026 feet high.

Lagoon.—A lagoon, lying parallel with the coast and having two shallow openings to the gulf, extends 8 or 9 miles northward from Rio del Fuerte.

Coast.—From Rio del Fuerte to Point San Ignacio, a distance of 19 miles, the coast trends about south, and is low and sandy, consisting of a series of islands on which are some low sand hills and a scanty growth of bushes. The islands are separated from the mainland by lagoons that lie parallel with the coast.

Estero de las Piedras opens on the gulf 6 miles south of the sand island off the mouth of the Rio del Fuerte. The entrance is about $\frac{1}{2}$ mile wide and has a narrow bar, over which the sea breaks, extending off a short distance.

Lechuguia Island, lying south of the Estero de las Piedras, is $8\frac{1}{2}$ miles long and from 1 to 2 miles wide, with a ridge of sand hills from 25 to 50 feet high and some scattered bushes. At its southern end is the Lechuguia Estero, with an entrance $1\frac{1}{4}$ miles wide, across which lies an island a mile long and $\frac{1}{4}$ mile wide.

Off Lechuguia Estero and extending around Point San Ignacio is a dangerous shoal over which the sea breaks heavily. Soundings of 5½ fathoms were obtained 4½ miles 298° from Point San Ignacio; the depth increasing suddenly to 60 and 100 fathoms a short distance to the southwestward.

Directions.—To clear this shoal, keep the San Ignacic Farallon bearing to the eastward of 165°. When the southern and highest

peak of the Sierra de San Pablo bears 50°, clears the northern end of the shoal.

Point San Ignacio is a low sandy point at the southern end of a small sand island which lies off the western end of Santa Maria Island, separated from it by a narrow shallow channel.

San Ignacio Bay.—From Point San Ignacio the coast turns sharply to the northward for about 2 miles, and then curves around to Santa Maria, at the southeastern end of Santa Maria Island, forming the open bay of San Ignacio.

There is good anchorage in San Ignacio Bay in 5 or 6 fathoms of water, from $\frac{1}{2}$ mile to a mile from the northern shore, with protection from the northwesterly winds, but entirely open to winds from the southward.

Santa Maria Island, which forms the north shore of San Ignacio Bay, is a sandy island, 13½ miles long, with an average width of about a mile, separated from the mainland by a lagoon. It has a steep beach, backed by a range of sand hills from 50 to 100 feet high, and a scanty growth of bushes.

Santa Maria Point, the southeast extremity of the island, is the northern point of the entrance to Topolobampo Harbor.

San Isnacio Farallon, the best landmark for making the entrance to Topolobampo Harbor, lies 13½ miles 240° from Santa Maria Peint, and is a small barren rock, of whitish color from a deposit of guano, about ½ mile in extent either way, and 465 feet high. There is deep water close-to on all sides except the north, where, close-to, are a few outlying rocks.

Topolobampo Harbor.—The entrance to Topolobampo Harbor is between two lines of breakers, and is exceedingly narrow and intricate. The bar is 2½ miles from the nearest land, Santa Maria Point, and is less than ½ mile wide at its deepest part, with 2½ fathoms of water on it at low tide. Within the bar the depth of water in the channel increases gradually until 10 to 12 fathoms are found. Steamers of 16 feet cross the bar at half tide, but no greater draft can be recommended. Vessels of this draft and less are exposed to the danger of striking lumps that form at times in the channel.

The channel is the only part of Topolobampo Harbor that is navigable for vessels of any size, the other parts of it being very shallow and full of shoals.

Directions.—The buoys on the bar at the entrance to Topolobampo Harbor may be out of place, and on entering or leaving the harbor it may be necessary to use natural ranges. The bar is liable to frequent and sudden changes, but the following ranges have been selected as most useful for the purposes of the navigator: Range No. 1.—The front mark of Range No. 1 is a bald-faced bluff, located 1.8 miles 111° from Shell Point, just southward of the point marked "256" on H. O. Chart No. 1335. This bluff is very conspicuous and can not well be mistaken. The rear range mark is a remarkable square-shouldered peak about 7 miles 85° from the bald-faced bluff. From the bar this peak just shows above the hills in front, but when off Shell Point it is square and very distinct, and the peak can not be mistaken for any other.

The range, marked by the highest point of the bald-faced bluff in one with the highest point of the square peak, bearing 85°, cuts the northern edge of the outermost shoal on the bar so that the range has to be kept well open to the northward until this shoal is passed. The best water has been found to be obtained by keeping this baldfaced bluff halfway between the square peak and the next peak to the right. When standing in on this latter range the ship will be just outside the bar when the beacon on Santa Maria Island bears about 43° and is in range with a sharp-pointed peak to the left of Camels Hump. When the beacon on Santa Maria Island bears 36° and is in range with the highest peak of the left range of hills, the course should be changed to head for the inner buoy. When Round Hill bears 45° begin to work onto the second range taking care that the vessel is to the southward of range bluff and square-shouldered peak in line (85°) until onto the second range. Inner buoy should be left on the starboard hand. Care should be taken when heading in on course 86° 30' not to be set to southward by an ebb tide. Vessels should keep to northward of this range until past outer buov.

Range No. 2.—The front mark of Range No. 2 is the small conical hill near the extreme eastern edge of the white sandy knoll 0.9 mile 267° from Round Hill. The rear range mark is the highest point of a hill called Monument Hill, which shows through a gap in the northern hills to the westward of Camels Hump. The course on this range is about 33°. Care should be taken not to get to the eastward of this range, especially when opposite Shell Point.

Range No. 3.—The front mark of Range No. 3 is a bare-faced bluff, smaller than the front mark of No. 1 Range, near the end of the next point to the eastward and about 2.6 miles 138° from Round Hill.

The rear mark is the same square peak that forms the rear mark of No. 1 Range.

Standing in on Range No. 2, make a sharp turn to the right and bring No. 3 Range on, bearing 91° 30′. Stand in on No. 3 Range past Shell Point until the bald-faced bluff of No. 1 Range shuts out all the high bluffs to the southward, then change the course to 59° and head for the rocky promontory 1¼ miles 226° from Mount San Carlos.

Anchorage.—There is excellent anchorage inside the shoals in 7 or 8 fathoms, sheltered from all winds. The best anchorage outside the bar, which is safe only in moderate weather, is in 8 or 10 fathoms of water, with Round Hill, a conspicuous sharp hill, 251 feet high, on the northern shore of the harbor, bearing 45°. The nearest breakers will then be 1 mile to the eastward.

Currents.—The tidal streams on the bar and in the channel are strong, and care is required to keep on the ranges.

Town.—Topolobampo is situated on the northern side of the channel near San Carlos Bay, and is the southern terminus of the Pacific division of the Kansas City, Mexico & Orient Railroad. This line has been completed for a distance of about 60 miles to Fuerte; 15 miles out is the settlement of Los Mochis, and at San Blas, 25 miles inland, the railroad crosses the Southern Pacific line. The railroad runs to a wharf at Topolobampo, which is built parallel to the shore, alongside of which any vessel that can cross the bar will find plenty of water. There is ordinarily regular communication by steamer and telegraph, but owing to the recent disturbed condition of the country the railroad and all business has been practically suspended, and at last reports traffic has not been resumed (1916).

The town has a population of about 300 persons.

The official of the town is the administrator of customs.

Tides.—It is high water, full and change, at Topolobampo at 9 hours 7 minutes. The spring rise 6 feet and the neaps 4 feet.

Landing.—Vessels may tie up alongside of the wharf in 18 feet of water; boats land at the eastern end of the wharf.

Sanitation.—There is no effort made at sanitation. The town is on a steep hill and has very little rain. There is no hospital or accommodation for the sick. There are swarms of gnats and mosquitoes. Malarial fevers are prevalent.

Weather.—The rainy season at Topolobampo usually begins about June 24, but is said to be very variable in duration and amount of rainfall. Heavy wind squalls are expected during September and October. During the latter part of July and the first part of August the temperature during the days is from 90° to 95° and at night about 85°. The prevailing direction of the wind is southward. During March and April the weather is cool and pleasant, wind northwest, with the bar much rougher than in August.

Supplies.—Beef and vegetables may be obtained from towns along the railroad by giving advance notice. Water can be obtained from the railroad company.

San Carlos Bay, lying northeastward of Topolobampo Harbor, and connected with it by a narrow strait or channel, has never been surveyed, but is known to extend 9 or 10 miles in a northeasterly direction and to have a width of from 4 to 6 miles.

After rounding the high headland on which Mount San Carlos, 817 feet high, is situated, a narrow intricate channel, with a gradually decreasing depth of water, was followed for about 3½ miles in a northeasterly direction; at that distance 3 fathoms were found. On either side of the channel the soundings were irregular, varying from 3 feet to 3 fathoms, with numerous sand bars and a few small islands.

Fish and turtle are abundant in the waters of the vicinity, and game is said to be plentiful in the interior. The vegetation in the vicinity of the harbor is very scanty.

Coast.—The coast from Topolobampo Bar to the mouth of the Sinaloa River, a distance of 41½ miles, with the exception of the high land near Topolobampo entrance, is low and sandy, being composed of a series of sand islands separated from the mainland by lagoons. Four miles southeastward of Shell Point the high land approaches the coast in bluffs from 20 to 50 feet in height, a sharp hill, 765 feet high, rising immediately behind them. Four miles farther is an entrance to the extensive lagoon that lies parallel with the coast, extending to and joining the Sinaloa River. Off this entrance, an extensive shoal, over which the sea breaks, with 3 fathoms of water on the cuter edge, extends $2\frac{1}{2}$ miles from the land.

San Ignacio Island, the westernmost of the series of islands forming the coast line between Topolobampo and the Sinaloa River, is 12\frac{3}{4} miles long and from \frac{3}{4} mile to 1\frac{1}{2} miles wide. Behind the lagoon that separates it from the mainland, the peaks of the Sierra de Navachista rise to a height of over 1,000 feet. In the northern part of the lagoon, nearly opposite the middle of San Ignacio Island, is a remarkable white rock 75 feet high.

Navachista Estero.—The entrance to Navachista Estero, between the eastern end of San Ignacio Island and the Island of Vinorama, is narrow and intricate, with about 2 fathoms on the bar at low water. The outer edge of the bar, which is ½ mile wide in its narrowest and deepest part, lies ½ miles from the nearest land; west of the channel, the shoals extend 2 miles off the land, the sea breaking over them continually. Within the bar the depth of water is from 5 to 7 fathoms. Tides rise about 5 feet.

Vinorama is a low sandy island about $1\frac{1}{2}$ miles long and $\frac{3}{4}$ mile wide, on which are several cetton farms or ranches; tolerably good fresh water may be obtained here by sinking wells.

Boca Macapule, lying at the east end of Vinorama Island, is narrow and shallow, the shoal water extending about a mile offshore.

Macapule Island, lying eastward of the Boca Macapule, is 11 miles long, parallel with the coast, and about a mile wide, a lagoon or estero of the same name separating it from the mainland. The southern beach is nearly straight, and is free from shoals, having

from 3 to 5 fathoms of water close to. At its eastern end is a small island on either side of which is a narrow opening to the estero.

The Sinaloa River empties into the gulf on either side of a small island covered with trees, the center of which is 4½ miles from the eastern end of Macapule Island. The river is useless for purposes of navigation. A shoal makes off about ½ mile from the island at its mouth, and the discolored water from the river is very marked for some distance.

The old town of Sinaloa, built on a hill and on the bank of the river, about 40 miles from its mouth, was formerly of some importance but it is now almost deserted.

Playa Colorada Estero has its entrance 7½ miles southeastward of the island at the mouth of the Sinaloa River. Off it are extensive shoals over which the sea breaks even in moderate weather. The depth of water on the bar is said to vary with the seasons, 9 feet being found at low water during the dry season, and 12 feet during the rainy season. As the bar is a shifting one, no reliable directions for crossing it can be given, and the only safe way is to sound out and mark the channel before attempting to enter. The deep water lies between the lines of breakers, and these are the best guides. Within the bar also the breakers are the best guide. Vessels usually take a pilot at Mazatlan. The customhouse, called Perihuete, is at the entrance and is a dependency of the customhouse at Mazatlan.

The anchorage is about 4 or 5 miles offshore, in 5 or 6 fathoms water.

Saliaca Island lies to the eastward of the entrance to Playa Colorada Estero. It is 4 miles long, about 1½ miles wide, low, sandy, and covered with a scanty growth of bushes. An estero of the same name separates it from the mainland.

Water can be obtained on the island by digging, care being taken not to dig too deep, as then the water, which is very good, becomes brackish.

Playa Colorada, a village containing aout 200 inhabitants, is situated 4 or 5 miles from the mouth of the estero of the same name. Large quantities of dyewood are annually shipped from here.

Coast.—From the western end of Saliaca Island the coast trends southeastward for 39½ miles to the entrance of Altata Estero. Throughout this entire distance the shore is low and dangerous of approach, not being visible at night as far as the outer limit of the shoals that make off from many parts of it. The lead should be freely used, the soundings being an excellent guide, and it is recommended not to get into less than 13 or 15 fathoms of water when navigating this part of the coast at night.

Altamura Island is southeast of Saliaca Island and separated from it by a shallow opening to the esteros lying between these

islands and the mainland; shoal water extends off this opening for a distance of nearly 2 miles.

The island is 24 miles long in a direction parallel with the coast, and from $1\frac{1}{2}$ to $2\frac{1}{2}$ miles wide. Like the other islands on this part of the coast, it is low and sandy, with some sand hills and bushes.

Altamura Point, a low indefinite point making out from the island about 7 miles from its southeastern end, is the northwestern limit of an extensive shoal that makes off 2 miles from the shore and extends 10 miles to the southeastward, across the mouth of Tule Estero.

Colorado Point is the southern end of Altamura Island and the northern point of the entrance to Tule Estero, which lies between Altamura and Baredito Islands. The shoal beginning at Altamura Point extends across the entrance of Tule Estero, the sea breaking heavily over it. The Culiacan Mountains, 2,000 feet high, in which the Tule River takes its rise, are about 25 miles eastward of the bar. The small town of Tule is situated on the bank of the Tule River, about 10 miles from the bar.

When off Tule Estero, Agua Pepa Peak, about 1,500 feet high and the westernmost of three prominent peaks, will bear 42°.

Baredito Island is of crescent form, about 10 miles long, with an average width of a little over $\frac{1}{2}$ mile. It forms the coast line between the entrance to Tule Estero and that of Altata, and is separated from the mainland by a lagoon. Like Altamura, it is low and sandy, with a scanty growth of bushes and some low sand hills.

Off its southern part a shoal on which there are heavy breakers makes out nearly 2 miles.

Altata Estero.—The old entrance to Altata Estero lies between the southeast end of Baredito Island and the northwest end of Lucenilla, a long narrow island separated from the mainland by the harbor of Altata. This entrance is completely closed. The new entrance is at the southeast end of Lucenilla, about 11 miles from the old entrance.

Tonina or South Bar.—The new entrance to Altata Estero, opened during the great cyclone of 1897, about 11 miles southeast of the town of Altata, is locally called the Tonina Bar. Since its opening, the sea has washed the sand from both points of the entrance, leaving the points under water or awash and depositing the sand inside the points, in the channel, so that now, in turning around the northern Tonina Sand-spit Shoal, there are but 12 feet of water in the main channel for about \(\frac{1}{4}\) mile. It is comparatively easy for vessels of 12-foot draft to enter, and sailing vessels should tow in and out. The outer bar has $4\frac{1}{2}$ fathoms over it at low tide, but is constantly changing. This locality has changed so extensively since the last survey that the chart is very inaccurate.

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The best mark (November, 1912) for making the entrance buoy is the wreck of a three-masted schooner, with masts upright, about ½ mile west of the observation spot shown on H. O. Chart No. 1794, in line with double peak on a bearing 45°. The channel is partly buoyed by the steamship companies whose vessels call here, but the buoys are not reliable.

There is one official pilot. The mean rise and fall of the tide is 4 feet.

Position.—A Mexican survey places the southeast extremity of Lucenilla Island in latitude 24° 32′ 30″ N., longitude 107° 50′ W.

Altata, a town of about 300 population, is the seaport of Culiacan, the capital of the State of Sinaloa, and is connected therewith by a railroad, 38 miles in length. There are no wharves or piers of any kind and practically no trade. Culiacan, a town of about 13,000 inhabitants, is situated on the bank of the Humaya or Culiacan River, about 30 miles from the coast.

Supplies.—No provisions or fresh water are obtainable, all water for drinking and cooking purposes for the town being brought in tank cars.

Communications.—A steamer of the Naviera Mexicana Line touches here about every three weeks. Altata is connected with the City of Mexico by telegraph. There is a daily inland mail to Culiacan.

Shoal.—A shoal of considerable extent was found about 12 miles offshore, with depths from 5½ to 8 fathoms. From the 5½-fathom sounding, the least obtained, the town of Altata bears 32°, distant 13 miles, and Tonina Bar Outer Buoy bears about 63°, distant about 12 miles.

Coast.—From the Tonina Bar to the Piastla River, a distance of 77 miles, the coast is almost a straight line of sand beach, broken only by Boca Tavala, covered with bushes and free from outlying dangers, with from $4\frac{1}{2}$ to 6 fathoms of water within $\frac{1}{2}$ mile of the beach. The low land stretches far away into the interior and is backed by moderately high ranges of hills or mountains.

A narrow lagoon extends from Altata Estero to a short distance southeastward of Boca Tavala, a strip of sand beach from ½ mile to a mile in width separating it from the waters of the gulf.

Boca Tavala, 29 miles from the Tonina Bar, is a narrow outlet from the lagoon, probably caused by the rush of water from the Tavala or San Lorenzo River, which empties into the lagoon a short distance to the eastward. A shoal with 3 fathoms on its outer edge extends 1½ miles off the entrance. The anchorage is in 6 or 7 fathoms 2 miles from the beach.

San Lorenzo River during the dry season is navigable only for coasters drawing not more than 5 feet. On its right bank, about 15

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Grueza Point, 13\frac{3}{4} miles southeastward of Point Piastla, is a rocky bluff, surmounted by a hill 77 feet high. About 5 miles northward of the point is an arroyo, and 2\frac{1}{2} miles southeastward of the point another arroyo.

Point Roja, about 5 miles below Grueza Point, is a low, very slightly projecting, bluff point, with low land behind it.

Camaron Point, a little more than 8 miles southeastward of Point Roja, is a rocky bluff about 50 feet high, with a hill of reddish color, 403 feet high, 2 miles to the eastward.

Between Camaron Point and the harbor of Mazatlan are several prominent islands and rocks, the former serving as landmarks in making Mazatlan.

Pajaros Island, the northernmost island, is about 3½ miles south-eastward of Camaron Point, and less than ½ mile from Arenilla Point, the nearest point of the mainland. It is about 800 yards in extent each way and 467 feet high.

Anchorage.—Very good anchorage may be had on the north side of Pajarcs Island. It is well to anchor in 6 fathoms of water, with 30 fathoms of chain, swinging into not less than 5 fathoms, in a position with the southeast point of Pajaros Island and the northwest point of Venados Island just open.

Off the northwest point of Pajaros Island, in line with the reef, uneven and foul bottom appears to extend a considerable distance. Rounding the point from the westward, a patch of 7 fathoms was found about ½ mile from the point, the depth dropping to 10 fathoms after passing it. About 1 mile off the point in the same direction, a patch was seen breaking occasionally, but, as the swell was heavy at the time, it is supposed that there are at least 5 fathoms over the patch.

Between Arenilla Point and Mazatlan are several lagoons, some of which are said to be of fresh water.

Venados Island, a mile southward of Pajaros, is rather larger than the latter, but of the same character; being rocky and barren. Bush Peak has an altitude of 587 feet.

The south part of Venados is connected with the main body by a narrow neck of land called El Cuello. A detached rock, called Estrella Rock, lies about 75 yards south of the southern extremity of the island.

The channel between Venados and the mainland is a little over $\frac{1}{2}$ mile wide, and $2\frac{1}{2}$ fathoms of water may be carried through it.

Creston Island, which forms the western side of the outer harbor of Mazatlan, is 800 yards long, nearly north and south, about

miles from its mouth, is the small town of Quila, and 8 miles farther up the town of San Lorenzo.

Elota River during the dry season is a mere creek and disappears in the sand near the coast, 33½ miles southeastward of Boca Tavala; during the rainy season it becomes a turbid torrent. The village of Elota is situated on its right bank, about 20 miles from the coast, in a partially cultivated but thinly populated country.

Sierra de San Sebastian, with peaks from 1,000 to 5,000 feet high, is from 15 to 25 miles behind the coast between the San Lorenzo and Elota Rivers.

Point San Miguel is a rocky point, with some close outlying rocks, situated about 6 miles southeastward of the mouth of the Elota River. A short distance behind it is the northwestern limit of a range of remarkable hills, known as the Cerros de Piastla, one of which, 920 feet high and of a triangular shape, called Cerro de las Vigas, is 2½ miles 102° from the point.

Four miles southeastward of San Miguel Point is a rocky bluff point of moderate height, with a mound 125 feet high immediately behind it.

Piastla River.—The mouth of the Piastla River is 4 miles southeastward of the rocky bluff point, just described, and 3 miles northward of Point Piastla. Like the Elota, it is a mere creek until the rains convert it into a torrent. Near the mouth of the river is a thick growth of trees and bushes, where good water may be obtained.

The village of Piastla is about 20 miles up the river.

Point Piastla, the southern of two rocky headlands lying about a mile apart, is 156 feet high and has a reef extending from it a short distance to the southward and westward.

Between Point Piastla and the mouth of the Piastla River, 4 mile from the northern headland, is a white rocky islet, 35 feet high.

Anchorage.—A sweep in the coast line between the mouth of the Piastla River and the northern headland forms a small bay or indentation, open to the northwestward, where vessels that come here for dyewood anchor in 5 or 6 fathoms, about a mile from the shore.

Pier.—A short distance eastward of the extremity of the northern headland is a landing pier with some huts near it; on a hill behind the pier is a signal pole.

Supplies.—Drinkable water can be obtained from a lagoon, a short distance from the beach, which is dry during the months of March, April, and May. Two wells sunk on the shore of the lagoon serve as cisterns or reservoirs. Not far from the landing place is a fertile plain where cattle may be obtained.

Coast.—The coast south of Point Piastla has the same general trend as that to the northward, and is for the most part low, sandy, and free from outlying dangers.

About $1\frac{1}{4}$ miles southeastward of Point Piastla is a bluff 80 feet high, and 2 miles farther is a shoal, over which the sea breaks, extending nearly $\frac{1}{2}$ mile offshore.

Grueza Point, 13\frac{3}{4} miles southeastward of Point Piastla, is a rocky bluff, surmounted by a hill 77 feet high. About 5 miles northward of the point is an arroyo, and 2\frac{1}{2} miles southeastward of the point another arroyo.

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The south part of Venados is connected with the main body by a narrow neck of land called El Cuello. A detached rock, called Estrella Rock, lies about 75 yards south of the southern extremity of the island.

The channel between Venados and the mainland is a little over $\frac{1}{2}$ mile wide, and $2\frac{1}{2}$ fathoms of water may be carried through it.

Creston Island, which forms the western side of the outer harbor of Mazatlan, is 800 yards long, nearly north and south, about

400 yards wide, and 470 feet high, with a coast line consisting chiefly of steep rocky bluffs. Within a mile northwestward of it are several islets and rocks, the most prominent of which are the north and the south Hermano Islets, the latter 152 feet high, and Tortuga Rock, 5 feet high.

Creston Island Light, occulting white, visible 31 miles, is shown at an elevation of 515 feet above the sea, from a square white tower, which rises from the center of a white building on the summit of Creston Island.

Wreck.—The wreck of a bark sunk in Mazatlan Harbor,, about 325 yards eastward of the north point of Creston Island, is marked by a green buoy established in 15 feet of water.

Azada Island lies north of Creston and between it and Pala Point. The channels north and northeast of it are navigable by only the smallest class of vessels; that on the south side is unsafe even for boats, being full of rocks.

Pala Point is the south extreme of a peninsula ½ mile long and ¼ mile wide, projecting south from a broader peninsula on which is situated the city of Mazatlan. The point is surmounted by a hill, 200 feet high, with a signal station from which all vessels are reported to the town, about ½ mile distant. On the bluff over the point is a fort of comparatively recent construction. Off the point and on both sides of the headland are numerous outlying rocks.

Mazatlan—Lights.—A fixed red light, elevated 22 feet above high water and visible 9 miles is shown from a black iron post beacon on a concrete base, 450 yards 165° from the light on the fiscal mole.

A fixed red electric light is shown from the head of the fiscal mole. These lights in line lead clear of Black Rock.

Mazatlan Harbor.—The outer and available part of the harbor of Mazatlan is of small extent, and includes the space lying between the island of Creston on the west and Chivos on the east. It affords good protection from the northwesterly winds, but is entirely open to the southward, and is a dangerous anchorage for sailing vessels during the rainy season. The holding ground is poor, the bottom being of rock or slate, and upon the first appearance of bad weather vessels should leave.

The northern and inner part of the harbor is very shoal and full of sand bars; it can be used by vessels of only the smallest class.

Chivos Island is similar in appearance to Creston and about half as high; it is partially covered with trees.

Cardones Island, 160 feet high, lies 800 yards east of Chivos. Westward of it nearly 3 mile are two rocks above water.

Black Rock, a small rock about 10 feet above water over which the sea generally breaks, lies just outside of Mazatlan Harbor. From it the lighthouse on Creston Island bears 323°, and the highest peak

of Chivos, 16°. The soundings in the vicinity of Black Rock show from 12 to 14 fathoms close to it, shoaling gradually toward Creston and Chivos Islands and the anchorage between them.

Blossom Rock is a dangerous pinnacle rock with 3 fathoms on it at low water. It lies in the outer part of the harbor, a little east of the best anchorage for large vessels, on the following bearings: Signal station on hill north of Pala Point, 329°; south bluff of Creston Island, 270°; Black Rock, 186°. Blossom Rock is marked by a black and red horizontally striped spherical buoy, but this mark should not be trusted, as it is frequently out of position.

Clearing mark.—Monte Silla Point open to the westward of Chivos Island clears Blossom Rock.

Monte Silla is a conspicuous saddle-shaped hill 256 feet high, situated on the point of the mainland, a little over ½ mile northeastward of Chivos Island.

Anchorage.—A good berth is in 8 or 9 fathoms of water, with South Bluff of Creston Island bearing 266° and the signal station on Pala Point 344°. An anchorage farther in may be chosen, guided by the lead, the soundings decreasing regularly to 3 fathoms; but going close in is objectionable in a large ship on account of the difficulty of getting under way, there being but scant room for maneuvering.

During the bad weather season, in September and October, it may be well to anchor farther out, or to the northwest of Creston Island, where there is more room for sailing vessels to get underway and to stand out clear of the land.

The harbor being an open roadstead, there is always a swell from the southwestward, and it is a good plan to lay out a heavy kedge astern to keep the ship's head to the sea. Occasionally the sea breaks from Pala Point straight across to the eastward, but generally boating is safe. The rock east of Pala Point is marked by a beacon and a buoy; the inner rocks are marked by a beacon.

The entrance to Astillero Channel is marked by a red buoy on the starboard side and a black buoy on the port side.

Tides.—High water, full and change, is at 9h. 40m.; springs rise 7 feet.

Mazatlan, the official name of which is La Villa de los Castillos, is the commercial center of the west coast of Mexico and the most important city on the Pacific coast between San Diego and Panama. The population is about 22,000, but varies with the seasons, being much greater in the dry than in the rainy season. In its exports Mazatlan stands second in the whole Republic, and its imports are large. It is the outlet for the products of many valuable mining districts and the receiving point of large quanties of English and

German goods imported directly from those countries. The trade of the city is almost entirely in the hands of foreigners.

The city, with its light-colored houses, presents a picturesque appearance, and in the better part of the town the buildings are handsome and commodious. The city is well regulated, and has a board of health, a civil and military hospital, several public schools, a casino organized by foreigners, a fine electric-light plant, and good waterworks. A drainage and sewerage system has recently been put in and the streets macadamized; streets and open spaces are kept fairly clean and considerable attention is paid to sanitation.

Schemes for harbor improvements have been discussed for many years, but as yet nothing has been done, and such matters seem to be left to the future.

The United States is represented by a consul and a vice consul.

Landing.—There is a pier off the customhouse and another for boat landing farther south; boats approaching the piers should pull for the ends, giving the shore a good berth, as there are several sunken rocks lying a short distance off on which boats would strike at half tide.

Nothing is allowed to be landed on the customhouse pier. Goods are landed on the beach in front of the customhouse by carriers.

Pilotage is compulsory, though not necessary.

Supplies.—Everything in the way of equipment or provisions that vessels require can be procured here. Fish, oysters, and turtle are plentiful. Fresh water of good quality can be procured in water boats from the local water company.

Coal is scarce and no supply is kept on hand; it is only incidentally that any can be had.

Repairs.—There is one machine shop where repairs to steamers may be effected.

Communications.—Mazatlan is in connection with the Federal Government telegraph system; there is also a radio station. The Pacific Mail S. S. Co.'s steamers between San Francisco and Panama touch here monthly going north and south; the Southern Pacific Railway Co. maintains a weekly steamer to Manzanillo; the Mexican steamship lines connecting with other coast ports call weekly; the Kosmos line of German steamers maintains a monthly service between Hamburg, Antwerp, London, and San Francisco, calling here both ways.

The exports are dyewcods, pearls, gold, and silver, almost all going to the United States.

The imports are cotton, linen, and woolen goods, a large proportion of which comes from England; also machinery, provisions, iron, and steel, the bulk of which comes from the United States.

Directions.—To reach the anchorage, coming from the westward, pass South Bluff of Creston Island at about 200 yards and steer 77° for the highest part of Cardones Island; anchor when the signal station on Pala Point bears 344°. The town will be opened shortly before reaching this bearing.

Coming from the southward, pass west of Black Rock, giving it a berth of about 200 yards, and steer 0° until South Bluff of Creston Island bears 266°, when anchor, the bearing of the signal station being as before.

Caution.—It must always be remembered that Monte Silla Point open to the westward of Chivos Island clears the Blossom Rock.

Coast.—From Mazatlan to the Chamatla River, a distance of 32½ miles, the coast is low and sandy, with a growth of bushes and stunted trees. There are no outlying dangers, the water deepening gradually from the shore to 10 or 12 fathems at a distance of 2 miles.

The Barron River empties into the gulf about 10 miles southeastward of Mazatlan. It is navigable in the dry season for only small boats and canoes. About 8 miles northeast of the mouth of the river, on the road from Mazatlan to San Blas and Tepic, is the old Presidio of Mazatlan, which was built by the Spaniards.

Metate Peak, 3,000 feet high, bears 25° from the north of Barron River, distant 15 miles. It is the northernmost peak of a range of mountains rising 9 or 10 miles from the coast, and is rather conspicuous.

A narrow lagoon lying parallel with the coast and about a mile behind it, extends from the Barron to the Chamatla River, a distance of about 22 miles. The mountain range, before mentioned, also stands nearly parallel with the coast line, a few miles behind the lagoon. La Cabeza de Caballo, a remarkable peak 1,979 feet high, is nearly midway between the Barron and Chamatla Rivers, and about 8 miles from the coast.

Chamatla River, which like the Barron is navigable in the dry season for only small boats and cances, has a shoal with less than 3 fathoms of water, extending 3 mile off from its mouth, the sea generally breaking over it. On either side of the river, a short distance from its mouth, are some hills from 500 to 900 feet high, known as the Chamatla Hills.

The small towns of Chamatla and Rosario are situated on the banks of the river, a few miles from its mouth.

Anchorage.—The anchorage off the mouth of the Chamatla River is in 6 or 7 fathoms, about 2 miles from the shore, the northernmost and highest peak, 3,738 feet high, of a mountain range over 3,000 feet high, which rises 18 or 20 miles from the coast, bearing 58°, distant 21 miles. Tides rise about 4½ feet.

Coast.—The coast south of the Chamatla River is the same in character as that north of it, and as far as the Boca Tecapan, a distance of 23 miles, has nearly the same general trend. Five miles southeastward of the mouth of the Chamatla, where the hills approach the coast, is a deserted Indian village, close to the beach.

Boca Tecapan is the outlet of two quite extensive lagoons, into the northern of which empties the Bayona River. A bar, the outer edge of which is nearly a mile offshore, extends 1½ miles on each side of the entrance, the sea breaking over it even in moderate weather. Leading into the estero are two channels, separated from each other by a shoal; in the northern channel there is a depth of 2 fathoms, and in the southern 2½ fathoms, at high water; with southeasterly winds there is said to be a depth of 4 fathoms. The best time to enter is early in the morning before the sea breeze springs up.

Nearly opposite the southern channel into the estero is a small Indian village called Palmito, where tolerably good fresh water may be obtained.

Anchorage.—The anchorage off Boca Tecapan is about $\frac{3}{4}$ mile from the outer edge of the bar, in 6 or 7 fathoms of water, the middle and higest peak of the Sierra Bayona, 2,588 feet high, bearing 72°, distant 14 miles. Spring tides rise 7 feet.

Bayona River, which enters the lagoon about 9 miles northward of Boca Tecapan, forms the boundary line between the States of Sinaloa and Jalisco.

Coast.—The coast south of Boca Tecapan trends nearly south, sweeping slightly to the eastward between the boca and a low, slightly projecting point, 28 miles from it. For over 27 miles from the Boca Tecapan, a lagoon lies nearly parallel with the coast, the strip of sand beach between it and the sea varying in width from 1 mile near the boca to 21 miles near the southern limit of the lagoon.

The country for many miles inland is low and level, several hills from 900 to 1,600 feet high, rising 15 or 20 miles from the coast, being the only ones seen throughout the entire distance. A few Indian huts and some patches of green bushes and trees are scattered along the coast.

Camichin Estero, 18 miles from the low, slightly projecting point, just mentioned, to Camichin Estero, is the outlet of an extensive lagoon which stretches northward. Off the entrance is a bar, over which the sea breaks. On the western shore of the lagoon, just above the entrance, is a small settlement. Vessels come here for cedar and dyewood.

The usual anchorage is off the mouth of the estero, in 5 or 6 fathoms of water, about a mile from the shore.

Isabel Island lies 17\frac{3}{4} miles from the nearest point of the mainland, its highest peak bearing 286° from the bar off Camichin Estero, 22 miles distant. It is about 1\frac{1}{2} miles long, \frac{1}{2} mile wide, and 280 feet high. Neither wood nor water can be obtained from the island, which is visited only by sealers.

Near the island are several detached rocks, the most prominent of which are two pinnacle rocks, nearly white, one 90 and other other 40 feet high, which lie near its northeastern side.

On the eastern and southeastern sides of the island are sand beaches, where landings may be effected in good weather. The soundings between Isabel Island and the coast are regular, decreasing from 20 fathoms near the island to 6 and 7 fathoms at 3½ miles from the coast.

Coast.—South of Camichin Estero the coast continues low and sandy. Between the mouth of the estero and San Blas, which is 19 miles to the southeastward, are the mouths of several lagoons and rivers.

Asadero Estero has a shoal of small extent off its entrance, which is $7\frac{1}{2}$ miles from that of Camichin. The anchorage is in 5 or 6 fathoms of water, about $\frac{1}{2}$ mile from the beach. Vessels come here for cedar, dyewood, etc.

Rio Grande de Santiago, or de Lerma, which takes its rise near the City of Mexico, feeds on its course Chapala Lake, which is over 50 miles long, drains the larger part of the State of Jalisco, and enters the Pacific Ocean about 4 miles southeastward of Asadero Estero. Guadalajara, the capital of Jalisco, is situated on the south bank of the river about 140 miles from its mouth. The river is much obstructed throughout its course by falls and rapids.

A dangerous shoal, over which the sea breaks heavily, extends nearly 4 miles off the mouth of the river.

Three miles southeastward from the mouth of the Santiago is the outlet of a lagoon which is fed by a branch of the river.

Piedra Blanca del Mar is a small white rock, 145 feet high, lying 5½ miles 258° from the mouth of the Rio Grande de Santiago. There is a safe passage between the rock and the shoal off the mouth of the river; from 8 to 9 fathoms will be found near the rock.

This rock is a good guide for making the port of San Blas, which lies about 12 miles to the eastward.

Tide rip.—A heavy tide rip with a sounding of 18 fathoms was reported 18½ miles 273° from San Blas Lighthouse, in latitude 21° 33′ N., longitude 105° 38′ W.

Piedra Blanca de Tierra is a small white rock 58 feet high, with two smaller ones, one northeastward and the other southwestward of it. It lies 1,200 yards 230° from San Blas Lighthouse, the channel between having a depth of from 3 to 5 fathoms.

Port San Blas.—The harbor of San Blas is nothing more than a small estero with very shoal water throughout the greater part of its extent. This harbor is very nearly closed now by a sand bar which has formed across the mouth of the estero, over which not more than 6 feet can be carried. Within, the depth is from 2 to 3 fathoms. The western shore of the estero is a narrow peninsula, and on its southern part are some hills, 106 feet high, with the ruins of fortifications on them.

San Blas is situated on the low ground on the eastern bank of the estero that forms the harbor. It was formerly much larger, and derived much profit and importance from being the port at which was disembarked the principal part of the merchandise destined for Guadalajara and the State of Jalisco. There is very little trade now, but a proposed railroad between San Blas and Tepic is expected to revive it. At the present time San Blas serves only as a landing place for goods destined for Tepic, a thriving town of 16,800 inhabitants some 30 miles inland, which is the capital and center of distribution of the territory. Tepic is widely known for its manufacture of cigars; it has also a cotton factory.

The old town of San Blas lies about 3 mile from the shore, on the landward slope of a steep hill 450 feet high and almost perpendicular on the side toward the sea. It is at present a mass of ruins, with trees and bushes growing among them. The ruins of the old monastery are well worth a visit.

The United States has no consular representation at San Blas.

The roadstead of San Blas is open and exposed to both of the prevailing winds. The anchorage is, however, safe in the dry season, and less dangerous during the rainy months than that of Mazatlan. The holding ground is of sand and is good. The extent and configuration of the roadstead make it easy of approach, and when leaving it the prevailing current often affords considerable assistance. It is recommended to avoid remaining here during the season of the "Cordonazos."

Anchorage.—A good anchorage is in 5½ or 6 fathoms of water, with Piedra Blanca de Tierra bearing 334° distant about ½ mile.

If it be desired to anchor nearer the town, the best position is in $4\frac{1}{2}$ fathoms, a scant $\frac{1}{2}$ mile eastward of the rock.

Port San Blas Light, group flashing white, visible 19 miles, is exhibited at a height of 155 feet from a square white wooden framework with white house at the base on Vigia Hill. The light has been reported unreliable.

Londing.—The boat landing is on the left bank of a small creek inside of the bar. As the surf is constantly breaking over the bar, it is advisable for boat officer or coxswain to make the trip in a shore boat before attempting to take in a ship's boat. It is reported that

in September, October, and November steamers are frequently unable to land passengers. A red flag hoisted at the signal station indicates that the bar is too rough to be attempted by ships' boats.

Tides.—High water, full and change, is at 9h. 41m.; springs rise 61 feet.

Port officials.—The officials to be visited are the administrator of customs and the chief of the port (mayor).

Seasons, winds.—The southerly winds begin in June and end in November; they are accompanied by much rain, do not blow steadily, are interrupted by frequent squalls from different points of the horizon, and generally wind up with a dangerous and violent storm. As this storm, which is always from between southeastward and southwestward, most commonly happens about the time of the festival of St. Francis, the 5th of October. it has received the local name "Cordonazo de San Francisco;" but it is sometimes considerably later, and then does the more damage from coming when the danger is no longer apprehended.

During the dry season the weather is constantly fine. The winds prevail regularly during the day from northwest to west, following the direction of the coast, and are succeeded at night by a light breeze from the land or a calm.

Health.—San Blas is very unhealthy, especially during the rainy season, when malignant fevers prevail; there are also clouds of mosquitoes and gnats the stings of which often cause painful and serious inflammatory disorders. At this season everyone who can do so leaves the town for Tepic and other inland towns in order to avoid the sickness and discomfort that accompany the rains. In the beginning of November, as soon as the rains subside, the people return, although this is the period described as being most unhealthy, when the ground is still moist and the heat of the sun not materially abated.

There is a regularly appointed health officer who boards all vessels upon arrival and enforces quarantine regulations.

Communications.—San Blas has a daily inland mail and is connected with the Mexican telegraph system. The Pacific Mail Steamers touch here once a month, each way, and the steamers of the Naviera Mexicana Line touch about every 10 days.

The Southern Pacific Railway Line has a weekly steamer to Manzanillo and Mazatlan.

Supplies.—Fresh beef is about the only thing which can be obtained here; other supplies are negligible. Water is brought a distance of about 7 miles from up the Estero.

Directions.—Coming from the westward, bound to San Blas, pass close to the southward of Piedra Blanca del Mar, and shape a course for Piedra Blanca de la Tierra, keeping it a little on the port bow and giving it in passing a borth of 300 or 400 yards. Desiring to anchor

nearer the town, pass between Piedra Blanca de la Tierra and the Castillo de la Entrada, and anchor eastward of the rock.

Coming from the southward, steer for the westernmost hill, Castillo de la Entrada, until near Piedra Blanca de la Tierra, then anchor as desired.

Caution.—In standing in for San Blas care must be taken not to fall to leeward, as there is a strong southerly current setting along the coast during the greater part of the year.

Landmark.—Mount San Juan, 7,550 feet high, is an excellent landmark for making the port of San Blas. It may be seen from a great distance, and is seldom obscured by fogs as are frequently the lowlands. When seen from the westward it appears to be saddle peaked, and on a bearing 107° is nearly in line with Piedra Blanca del Mar and Piedra Blanca de la Tierra. The coast range, from 1,000 to 3,000 feet high, is between Mount San Juan and the coast.

The land southward of San Blas is high, while that to the northward is low.

The coast of San Blas to Punta Raza is mountainous, and stands in marked contrast with the monotonous sandy plains farther north.

Camaron Point, about 2½ miles southeastward of San Blas, is a sharp bluff point, with a ridge of hills terminating just behind it; off it are some outlying islets and rocks.

Ensenada Matenchen.—At Camaron Point the coast turns sharply to the northeastward for about 13 miles, and then curves around to the southward, forming an open bay called Ensenada Matenchen, on the northern shore of which fresh water may be obtained. Shoal water extends ½ mile off the shore of the bay, and some detached rocks lie eastward of Camaron Point.

Santa Cruz Point, with the river and village of the same name, are at the southern limit of Ensenada Matenchen. The high bluffs of the point have a reddish color and are very prominent. In approaching from the southward the villages of Santa Cruz and Miramar are difficult to pick up owing to their groves of trees.

Punta Los Custodios is 5½ miles southward of Santa Cruz Point, several steep bluff points, from 45 to 75 feet high, intervening. It is a rocky bluff point about 30 feet high, the coast range of hills rising abruptly behind it. The Custodios River, which enters the sea just south of the point, has at its mouth a bar on which the sea breaks.

From this point a low straight sand beach extends southward for a distance of 8 miles, the land behind it covered with trees and bushes. Near the southern limit of this sand beach is a small stream known as the Chila River.

Ensenada Chacala is a small cove 13 miles south of the southern limit of the sand beach just mentioned, a bluff point 40 feet high intervening. From the shore of the cove hills rise abruptly to a height of over 300 feet.

Tecusitan Point, a mile and a half south of Ensenada Chacala, with some outlying rocks between them, is a rocky bluff point, 70 feet high.

About 10 miles 103° from Tecusitan Point, is Cerro Compostella, a prominent peak of the main range of mountains, which extends parallel with the coast. It is 4,262 feet high and affords a good landmark.

Jaltemba Bay.—Between Tecusitan Point and Punta Raza, 6 miles distant, the coast recedes somewhat, forming the open bay of Jaltemba, in which vessels may anchor and find shelter from southeasterly winds.

The shore of the bay is sandy, and the land behind it, which rises gradually, is covered with a thick growth of trees and bushes. A line of soundings run from point to point across the bay showed no bottom at 13 fathoms.

A small whitish-colored islet, 80 feet high, lies about 2 miles north-eastward of Punta Raza and about 3 mile from the shore. South of the islet, distant about 1 mile, is a black rock 20 feet high. Vessels that come to Jaltemba Bay to load dyewood anchor between the islet and the shore.

A little over a mile eastward of Punta Raza, on the shore of the bay, is a small fresh-water stream.

Punta Raza is a reddish-colored bluff point about 30 feet high, with hills rising abruptly behind it. Deep water extends close up to the point, 20 fathoms being found at a distance of 1 mile, and no bottom at 13 fathoms within $\frac{1}{4}$ mile.

Coast.—From Punta Raza the coast has a general trend southeastward for 21½ miles, to Punta Mita, the northern point of the entrance to Banderas Bay, and is a succession of bluffs alternating with sand beaches. The coast range, varying in height from 300 to 1,000 feet, borders on the sea throughout the entire distance. A short distance from the coast is a higher range of mountains, the most conspicuous peak of which, Cerro Vallejo, 5,036 feet high, is 10¾ miles eastward of Monterey Point, and 7¾ miles distant from the nearest part of the coast.

Monterey Point, 83 miles southwestward of Punta Raza, is a ragged bluff, with some outlying rocks on its northeast side. Three miles northeastward of it, close to the shore, is an Indian village.

Santa Cruzita Point, 4½ miles southwestward of Monterey Point, like the latter, is a ragged bluff point.

Punta Mita, a low narrow projecting point, is surrounded by outlying rocks and reefs, which make a near approach to it dangerous. A mile and a half northeastward of the point is a prominent hill, 454 feet high, and on the coast northward of the hill a steep rocky bluff, 60 feet high. From the bluff the coast sweeps to the eastward 1½ miles, forming a small bight, open to the northward, with lowland covered with trees and bushes between it and Banderas Bay to the southward.

For nearly $\frac{1}{2}$ mile westward of Punta Mita there are outlying rocks and shoals, outside of which the depth of water increases quickly to 15 and 20 fathoms.

Shoal and rock.—A dangerous shoal and rock awash, over which the sea breaks in rough weather, lies 1 mile 202° from Punta Mita. In the rassage between the rock and the point there are from $2\frac{\pi}{4}$ to 4 fathoms of water.

Las Tres Marietas are a group of small islands, rocks, and shoals extending 5½ miles in a general east-northeasterly and west-south-westerly direction, the easternmost and largest of which is on a line between Punta Mita and Cape Corrientes, bearing from the former 201°, distant 4½ miles.

The easternmost island is less than ½ mile in extent and 179 feet high, rising in broken white cliffs to the higher parts, which appear flat. A mile westward of it is the second of the group, somewhat smaller than the first, but similar to it in character, and 132 feet high. Surrounding this island and in the channel between it and the first are numerous detached rocks. A mile and a half farther westward, its center bearing 221°, from Punta Mita, distant 6¾ miles, is a reef of rocks above and below water, with deep water close-to. The third island of the group is 1½ miles westward of the reef, and 8 miles 228° from Punta Mita; it is merely a white rock 40 feet high; ½ mile westward of it is a smaller rock 15 feet high; there are 40 fathoms of water close to these rocks.

Channel.—Between the Tres Marietas and Punta Mita is a clear safe channel; but in using it care must be taken to avoid the rock awash that lies a mile southward of Punta Mita. This is easily done by keeping a little nearer the islands than the point.

Anchorage.—There is an excellent anchorage during the season of the northwest winds $1\frac{1}{2}$ miles eastward of Punta Mita, in from 5 to 7 fathoms of water, from $\frac{1}{2}$ to $\frac{3}{4}$ mile offshore, the hill 454 feet high, northeastward of the point, bearing 340°.

Supplies.—Fresh water in small quantities may be found near the beach. Game abounds in the interior. A species of wild turkey, called by the natives chachalaca, is found in large flocks and furnishes excellent meat. Corvetena Rock, which is of whitish color, 600 yards in length and 25 feet high, lies 17 miles 263° from Punta Mita. It is of irregular shape, with a very jagged top, and on a clear day can be seen from the deck of an ordinary vessel at a distance of 8 or 10 miles. There are 40 fathoms of water close to the rock, and from 50 to 100 fathoms between it and Punta Mita.

Current.—Strong currents have been noticed in the vicinity of Corvetena Rock. Some reports have shown a southeasterly set and recent carefully checked information indicated a westerly set. They are apparently variable and should be guarded against.

Banderas Bay, sometimes called Valle de Banderas Bay, is formed by a deep indentation in the coast between Punta Mita and Cape Corrientes. It is 20 miles long, east and west, with an average width of about 15 miles. The northern shore of the bay, as far as Piedra Blanca Point, 7\frac{3}{4} miles from Punta Mita, with the exception of a short strip of sand beach just east of the latter point, is composed of broken bluffs from 10 to 20 feet high. From Piedra Blanca Point to the Rio Real, which enters the head of the bay, the shore is a sandy beach. The southern shore from the Rio Real to Cape Corrientes is high and precipitous, with occasional valleys and sand beaches where small fresh-water streams enter the bay. The water along the southern shore is very deep.

Pedredero Point, 5 miles eastward of Punta Mita, is a rocky point with a large outlying rock off it. Two and a half miles northeastward from it are some conspicuous hills over 1,800 feet high.

Piedra Blanca Point, which is surmounted by a hill 326 feet high, lies about 3 miles eastward of Pedredero Point. Along this part of the coast are some outlying rocks, close-to.

Eastward of Piedra Blanca Point is a small bay where excellent anchorage may be found in the season of northwest winds.

Estero de Tomates, into which the Rio del Valle or Piginto River discharges, opens $7\frac{3}{4}$ miles southeastward of Piedra Blanca Point, the intermediate coast, which recedes considerably to the northward, being low, sandy, and covered with bushes; the soundings off it increase regularly from 3 to 5 fathoms near the shore to 15 and 20 fathoms a mile or so off. The Piginto is reported to be navigable for nearly 20 miles by vessels drawing 10 feet.

Shoal.—Off the mouth of the estero is a shoal, over which the sea breaks. Outside of this shoal the soundings increase very rapidly, 99 fathoms, rocky bottom, being found 4 mile from the mouth of the estero.

Peñas.—The village of Peñas, on a hill near the shore, about 4 miles scutheastward of the mouth of the Estero de Tomates, on the north bank of the Rio Real. The hills behind Peñas rise abruptly to a height of over 1,000 feet, and high mountains are plainly visible.

10 or 20 miles to the eastward. One and a half miles northward from Peñas is a grove of palms, and a lagoon called Estero de Paran. Ordinary fresh supplies may be obtained in large quantities and at reasonable prices.

Anchorage.—There is an anchorage in good weather 800 yards 5° from Rocky Point. The depths at Peñas anchorage have been found to be less than charted (1914). Vessels come here for dyewood.

Fresh water of excellent quality may be obtained from the river. **Peñas Range Lights.**—Two fixed red leading lights are shown from red and white striped wooden posts at Peñas.

Los Arcos are three rocks lying near the southern shore of the bay, between 4 and 5 miles southwestward of the mouth of the Rio Real. The highest of these rocks is 291 feet high; the other two are 20 and 30 feet high, respectively.

From Los Arcos to Cape Corrientes the coast is bold and backed by mountains from 2,000 to 3,000 feet high. Soundings obtained off it gave no bottom at 100 fathoms, a mile from the beach. There are some outlying rocks off the rocky bluff points, and at the mouths of the several fresh-water streams are collections of Indian huts.

Chimo Point is a rocky headland 7 miles northeastward of Cape Corrientes. Just east of the point is a reef of rocks, and a short distance westward of the point a white rock 40 feet high. The Chimo River enters the bay on the eastern side of the point.

Tabo Point and Bay.—Tabo Point, $4\frac{1}{2}$ miles southwestward of Chimo Point, forms the northeastern limit of Tabo Bay, which is a small open bay at the head of which is a small stream of the same name, with a few Indian huts on the banks. There is no anchorage in Tabo Bay on account of the great depth of water, 60 fathoms being found within a ship's length of the shore.

Corrales Harbor.—West of Tabo Bay, separated from it by a high hill, is the so-called harbor of Corrales, the western limit of which is only $\frac{1}{2}$ mile from Cape Corrientes. It is about $\frac{1}{2}$ mile in extent, but affords no convenient anchorage because of the depth of water, 30 fathoms being found in the center and 4 fathoms within an oar's length of the beach all around.

A sunken rock, on which the sea breaks in rough weather, lies off the mouth of the harbor, about 600 yards from the shore. A good landing may be had in this bay.

Cape Corrientes, the southern point of the entrance to Banderas Bay, is described at the beginning of Chapter VIII.

CHAPTER VII.

OUTLYING ISLANDS OFF THE MEXICAN COAST: LAS TRES MARIAS—REVILLA GIGEDO—CLARION—CLIPPERTON—OCEANA BANK.

Las Tres Marias Islands lie at their nearest point about 60 miles norhwestward from Cape Corrientes, and the middle of the group about the same distance west of San Blas, extending 39 miles in a general northwest and southeast direction. They are of volcanic origin, and their western sides are high, inaccessible, barren cliffs, while the eastern sides are generally low and sandy, with some vegetation.

It is reported that Las Tres Marias Islands are charted too far west by about 3 miles, and until definitely located navigators should exercise caution.

Cleopha, the southernmost island, is nearly circular in form, with a diameter of about 3 miles. The highest peak has an altitude of 1,320 feet. A pinnacle rock, 100 feet high, lies 1,600 yards off the southeast point, and a white rock, 225 feet high, lies ½ mile off the westernmost point. A shoal on which there is a rock awash extends ½ mile from the northeast extreme, and numerous smaller detached rocks lie a short distance off the bold bluff points. The southeastern point is a yellowish bluff, surmounted by a steep hill 250 feet high. A heavy surf beats against all sides of the island.

Magdalena is 8 miles long, east and west, with a greatest width of $4\frac{1}{2}$ miles, and its highest peak is 1,500 feet above the sea level. Just south of the eastern extreme of the island, which is a yellowish bluff about 200 feet high, is a small bight with 11 fathoms and more of water, rocky bottom. The northeast point of the island is low and gravelly; a short distance west of it is a small lagoon. The shore of the north side of the island is a fine sandy beach, the land sloping gradually toward the interior; about midway of its length shoal water extends off about $\frac{1}{2}$ mile. Off all the salient bluff points of the island are outlying rocks at distances from $\frac{1}{4}$ to $\frac{1}{2}$ mile from the shore.

There is considerable vegetation on this island, although the soil is of a sandy nature. The most valuable of its products is lignum-vitæ, besides which there is an almost impenetrable thicket of small

trees and bushes of a thorny nature, together with the prickly pear and some plans of the orange and lemon species. Fish abound near its shores.

The channel between Cleopha and Magdalena Islands is 8 miles wide and free from all dangers.

Maria Madre, the largest of the group, is 11½ miles long and from 3 to 6 miles wide. The highest peak, near the center of the island, is 2,020 feet high; but the peak in the center of the southwestern side of the island is the most prominent.

The south extreme of the island is a bold rocky headland 125 feet high, with several detached rocks lying off it. Eastward of this headland there is tolerable anchorage in from 7 to 11 fathoms of water, and a sand beach where boats may land in good weather.

Freth water of an inferior quality may be procured in this part of the island by sinking wells.

From the northwest extremity a dangerous reef extends nearly a mile toward San Juanito Island. Two miles south of the northwest point, and 4 mile from the western shore of the island, is a detached rock, 5 feet above water, with a sunken rock between it and the shore.

On the southeast face there is a small settlement of 15 or 20 people, occupied in collecting salt from a lagoon near by. This salt is shipped to Mexico.

The channel between Magdalena and Maria Madre is 4 miles wide and free from dangers.

Maria Modre Island Light, group flashing white, visible 24 miles is exhibited at a height of 275 feet from a white square stone tower on Balleto Point.

A radio telegraph station is located on this island, available for public use from 8 a. m. to 1 p. m.; call letters, X. A. D.

San Juanito, the northernmost and smallest of the group, lies 2 miles northwestward of Maria Madre. It is 2½ miles long, with a greatest width of 1½ miles, and about 200 feet high at its northern end, whence it slopes gradually to the southward.

From its southern end a reef extends a mile toward Maria Madre, which, with the reef extending off the northwest point of the latter, renders the channel between them extremely dangerous.

White Rock.—A remarkable white rock, 150 feet high, lies a mile off the western shore of San Juanito.

Caution.—The soundings increase very rapidly from the shore of there islands, at 2 miles no bottom being found at 100 fathoms. Calms, eddy winds, and southerly currents must be guarded against when ravigating the channels between them.

Revilla Gisedo Islands comprise a group of four islands of volcanic origin, lying between 18° 20′ and 19° 20′ north latitude, and 110° 45′ and 114° 50′ west longitude.

Socorro, the largest island of the group, may be said to consist of one mountain, which rises from the deep water surrounding it to a height of 3,707 feet, and is visible in clear weather at a distance of at least 70 miles.

As viewed from the sea the island presents a barren and uninviting appearance; the ground is covered with a thick and almost impenetrable growth of flat cactus and sagelike brush, the branches of which are so closely entwined and interwoven that progress through them is very laborious and difficult. The volcanic nature of the island is everywhere apparent; quantities of lava strew the slopes in isolated patches, as if forced directly up from beneath the surface, and the red soil is plentifully mixed with ashes; the hill on the east side of Braithwaite Bay is formed entirely of ashes. The surface is broken by hummocks and craterlike mounds, and in some places furrowed by deep ravines walled with lava. There is some grass, but not much, and the vegetation is of a low order. On the northern slope of the island, however, the prospect is somewhat more pleasing. A kind of bean grows abundantly on a vine that runs along the ground, which, when cooked and eaten in moderation, is apparently wholesome.

The sea face of the island, on the west, is extremely picturesque, comprising a series of preciptous cliffs in which the sea has worked numerous caves and formed many spouting rocks. About ½ mile northward of Rugged Point is a natural stone bridge, plainly visible from the sea. To the southward of Cape Middleton is a conspicuous sandy beach which would make a good landing place in easterly and southeasterly blows.

As there is an abundance of animal life on the island, it probably proves the existence of fresh water, but none has ever been reported. Birds, such as robins, canaries, swallows, and blue herons, are plentiful.

The shores of the island abound in fish, turtle, crabs, and craw-fish, and the vicinity with whales, sharks, and porpoises.

Cape Rule, the scuthern extremity of Socorro, is a high rocky bluff, surmounted by a hill 250 feet high. A little to the eastward of the cape is "the Cove," a small identation with a stony beach, and in the middle a small sand beach where the only good landing will be found.

Braithwaite Bay, the second indentation eastward of Cape Rule, affords good anchorage during the fine season, from December to June, with any but southerly and easterly winds. The beach at the head of the bay is a mixture of stones and rocky ledges, on which boats can land without much trouble, the weather being fair.

The bay is readily distinguished by the stony beach, the only one on the south side of the island, except that of "the Cove."

To anchor in this bay bring the highest peak of the island to bear 336°, and anchor in 10 or 11 fathoms, ½ mile from the beach.

cornwallis Bay, on the southwest side of the island, is considered to be the safer anchorage from June to December, as the wind seldom blows more than two points to the southward of east. The anchorage is opposite two white coral beaches, the first two from the south point of the island, toward the west. It is necessary to anchor quite near the beach, as the water deepens quickly offshore; the depth for anchoring is not stated. In the western part of the bay are some pinnacle rocks 30 feet high. Binner's Cove, in the eastern part of the bay, is mentioned as a landing place.

Rugged Point is the west extreme of the island; north of it is a small bay, near the head of which is a double-pinnacle rock 25 feet high.

Cape Henslow, at the northern limit of the bay just mentioned, is a finger-shaped peninsula about a mile long, composed of volcanic rocks in perpendicular cliffs 150 to 200 feet high. It is connected to the mainland by a narrow isthmus of sand. The northern side of this isthmus is a sheltered cove where a landing can easily be made in all winds except northwesterly to westerly. The south side of the isthmus is an open bight on which the prevailing swell breaks heavily. There are many rocks to the northward of Cape Henslow, and approach to the above landing should be made with caution.

Oneal Rock, lying a mile 335° from Cape Henslow, is about ½ mile long and 45 feet high, with deep water close-to. Several other rocks lie off the northwest face of the island, between Cape Henslow and Cape Middleton.

Cape Middleton, the northernmost point of the island, is an arrowhead-shaped peninsula with a neck of sand about 200 yards long connecting it with the island. This isthmus separates two deep bights which make it from the sea on either side and end in sloping beaches at their heads. The eastern bight extends in nearly a mile from the open sea. A rocky reef on its northern side form a more or less complete breakwater from northerly weather for half a mile or more beyond the outer end of the bight. This bight, being almost completely landlocked, should form an excellent boat landing except perhaps during easterly storms, and is sufficiently wide and probably not too deep to form an anchorage for small vessels. Any vessel entering the bight should keep well clear of two sunken rocks about 50 yards offshore on the southern side, between red cliffs and outer sand beach. The bight on the western side of the isthmus is not so deep or well protected, but it is well protected from everything except northerly and westerly storms. No anchorage is available here owing to the off-lying rocks. Boats entering should keep to the right of the arch rock which partially covers the entrance, 200

yard offshore, until the bight opens up. The beach at the head of either bight is gradually sloping and shows evidence of being seldom disturbed by storms.

Cape Pearce, the easternmost point, has some outlying rocks: close-to; behind it is a range of table mountains about 1,000 feet high.

About 4 miles to the northwestward of Cape Pearce is a sandy beach on which landing can easily be made in westerly winds. There is a considerable bight at this landing.

San Benedicto Island, lying 30 miles 17° from the highest point of Socorro, is a barren rock 3 miles long and from $\frac{1}{2}$ to $\frac{3}{4}$ mile wide. The highest peak, near the southern end, is 975 feet high, and another peak near the middle of the island is 683 feet high; these two peaks, when seen from a distance, have the appearance of two distinct islets.

Landing.—On the eastern side of the island, near the middle, is a small shingle beach which affords the best landing, but other portions of the island can not be reached from it; it is possible to land on the rocks at the foot of the bluff farther to the northward. There is fairly good anchorage off the shingle beach.

Rocks.—Three small detached rocks, respectively 60, 150, and 200 feet high, lie close to the western shore of the island a little north of the middle. A dangerous sunken rock lies about a mile westward of the extreme western point, covered by 10 to 12 feet of water.

Roca Partida is a dangerous barren rock, 100 yards long, 50 yards wide, and 110 feet high, lying 67 miles 280° from the highest part of Socorro. It consists of two white pinnacle rocks connected by a low ridge 20 feet high. The low part not being visible very far, the islet has the appearance of two separate rocks, and from a distance looks like a vessel under jury masts.

Soundings of 35 fathoms were found all around it at a boat's length from the rock. At $\frac{1}{2}$ mile distant 50 fathoms were found, and beyond that no bottom at 100 fathoms.

Clarion Island, the westernmost of the Revilla Gigedo Group, is of volcanic origin and of the same general character as Socorro, from which it bears 263°, distant 214 miles. It is a little over 5 miles long, nearly east and west, from 1 to 2 miles wide, being widest at its western end, and is covered with a thick growth of cactus. There are three prominent peaks, 1,100, 933, and 959 feet high, respectively, the highest being near the western end.

The eastern and western sides of the island are rough and precipitous. The northern face is a series of perpendicular rocky cliffs several hundred feet high, which culminate in a ridge running nearly east and west. From this ridge the land slopes, rapidly at first, and then more gradually, to a flat plateau which stretches from the foot of the hills to the sea in the neighborhood of the two sand beaches on the south side.

Sulphur Bay.—On the south side of the island are two indentations with sand beaches, the only two places of the kind on the island; the western of these, called Sulphur Bay, its western limit, 1½ miles from Recky Point, the southwest point of the island, affords tolerable anchorage during northerly winds, in 12 or 13 fathoms of water, 600 yards from the sand beach. In the eastern indentation breakers extend out ½ mile from the beach.

A safe landing can be effected in moderate weather on the sandy beach on the west side of Sulphur Bay. No attempt should be made to land elsewhere on account of the heavy surf.

Shag Rock, 40 feet high, with numerous smaller rocks close to it, lies off the east side of the island, close to a bold bluff.

Monument Rock, off the northwest point of the island, is a remarkable object and a prominent landmark, plainly visible at a distance of many miles; it is 200 feet high, with an almost square base, and is surmounted by a broken pyramidal shaft of alternate layers of red and white conglomerate rock; near the corners of the base are pinnacle rocks of various heights and shapes. Between the Monument Rock and the point are a number of smaller rocks.

Off the north side of the island, 14 miles from the northwest point and about 375 yards from the shore, is a detached rock 25 feet high.

Remarks.—Search parties in 1892 covered about 6 miles of the southern coast. That part of the island west of Sulphur Bay is thickly covered with cactus and difficult to penetrate.

The vegetation on the island comprises, besides cactus and grass, a dense growth of weed, which has a thick fleshy lanceclate leaf, trailing vines having rcd and yellow flowers, a species of wild bean, low thorny bushes, and morning-glories.

No fresh water was found, but animal life was abundant. The island seems to be a place of habitation and mating for sea fowl, of which tens of thousands were found laying their eggs in the sand near the beach or in nests in the clefts of the hills. Besides gulls and gannets, there were doves, owls, crows, and numerous song birds.

No wood suitable for fuel grows on the island.

The beach east of Sulphur Bay is composed of white coral and sand. Near the center of the beach, where the surf is the heaviest, the coral is banked up in three well-defined terraces.

Near this point also was discovered the bed of a brook, which was traced a short distance back from the sea. There was no water in it, but in the wet season it doubtless contains a considerable stream. The legoons marked on the chart near Sulphur Bay were dry, but no deposit of salt was visible.

Several turtles were seen close to the beach, while in the water around the island, as at Secorro, whales, sharks, and porpoises are numerous. Soundings obtained south of Clarion Island gave 20 fathoms and over $\frac{1}{2}$ mile from shore, increasing to 40 and 50 fathoms at a mile distant. Between Clarion and Socorro the general depth is nearly 2,000 fathoms.

Current.—In the vicinity of the Revilla Gigedo Islands the current is southerly, with a velocity of from ½ to 1 knot an hour.

Reported islands and shoals.—Careful search has been made for the many islands and shoals that have been reported in this vicinity at different times, without finding them or any indication of them.

Clipperton Island, which lies about 670 miles 234° from Acapulco Harbor, is a very dangerous low lagoon island, about 2 miles in diameter, with a prominent rock 62 feet high on its southeastern edge, which when first in sight appears not unlike a sail, but on a nearer approach presents the appearance of an immense castle. This rock (Lat. 10° 17′ N., Long. 109° 13′ W.) can be seen at a distance of 12 to 15 miles, but in thick weather the island itself will not be distinguished until close to it. The breakers on the eastern side do not afford sufficient warning to enable a vessel to change her course to avoid them. When bearing 225° the rock is said to appear exactly like a ship under sail.

The island, which is entirely destitute of vegetation, consists of a low coral belt of sand-like appearance and annular shape, the width of the belt or ring varying from a few yards to $\frac{1}{4}$ mile, and the height from 5 to 8 feet; the space within the ring, comprising most of the island, is occupied by a large lagoon of circular shape, with a depth varying from a few inches to 55 fathoms or more.

The island is fringed by a continuous coral reef and coral rocks, which partly uncover at low water. On the reef the sea breaks heavily and continually, the surf being terrific and at times covering the whole island. The two openings or entrances to the lagoon that formerly existed, one to the northeast and the other to the southeast, are now entirely closed. The lagoon water is brackish and during the dry season, from December to May, smells strongly of ammonia. Small fish are plentiful in the lagoon, but are not good eating. Five small islands in the northwestern part of the lagoon are called Egg Islands on account of the numerous eggs deposited there by the countless sea birds; these eggs are good eating. Sharks swarm about the island; fish and crayfish abound and are easily taken, but turtles are never seen. During the rainy season waterspouts break on the southwest side.

The island is leased by the Mexican Government to the Pacific Islands Co. A wharf 424 feet long has been built out to the edge of the reef at the new settlement on the southwest side of the

island, but as the sea breaks outside of it, it will have to be extended before it can be made use of. The concession has not been operated since 1914. All settlers were removed in 1917.

Anchorage.—The anchorage is on the northeast side of the island, in 20 to 45 fathoms, shelving coral bottom and good holding ground, with the rock bearing about 177°. Vessels at anchor should have their cables ready to slip on account of the prevalence of heavy squalls from east-northeast to north.

Landing.—The safest boat landing is on the beach, about ‡ mile southeastward from the anchorage; the reef fringe is narrowed at this point.

Tides.—The rise and fall of the tide is about 4 feet; the set of the currents, northwest and southeast. The tides are very irregular and greatly influenced by the winds.

Currents.—The current sometimes runs west $2\frac{1}{2}$ knots per hour, also east, and sometimes there is little or no current; but when to the eastward of the island in a calm there is a strong easterly set 20 miles off, but no westerly set has been reported.

Soundings.—The lead is of no use whatever in approaching the islands, soundings a mile off giving no bottom at 150 fathoms. On the northeast side, near the anchorage and landing place, there are 10 to 19 fathoms at the edge of the reef and 60 fathoms within $\frac{1}{4}$ mile.

Caution.—Clipperton Island is a dangerous place at the best of times, and should always be approached with great caution.

Oceana Bank is marked by discolored water. The least reported depth, 63 fathoms, hard bottom, is in latitude 8° 24′ N., longitude 115° 25′ W.

CHAPTER VIII.

THE COAST OF MEXICO FROM CAPE CORRIENTES TO THE OCOS RIVER.

Cape Corrientes, which derives its name from the currents off it, is a bold headland with a flat summit, 506 feet high, the land behind it rising at a short distance to a height of 2,000 feet. Close to the cape is a large outlying rock; soundings obtained 600 yards from it gave 145 fathoms. On approaching the cape from any direction the highland behind it is first seen. The mountains are covered with woods, which in the rainy season are green and in the dry season dark brown. From the northward and westward the cape does not present a remarkable appearance, but from the southward and eastward it is bold and projecting. It may also be distinguished by a white rock patch well down on the side of the slope, and by the red-dish-brown rocks at the base, whereas the points near it are grayish bluffs and rocks.

There are no dangers off the cape which can not be seen, and a vessel can pass it in safety within ‡ mile. Westward of the cape is a submarine ridge with 50 fathoms on it and deep water both outside and inside of it; this may account for some of the tide rips and broken water seen at times off this point.

Cape Corrientes Light, on the slope of the wooded mountain, is flashing white, visible 24 miles, and is exhibited at a height of 305 feet from a white octagonal tower with dwelling at base.

Landing.—A heavy sea breaks on the beach, so that landing is here impracticable, but a good landing may be had in Corrales Bay about $\frac{1}{2}$ mile northward and eastward of the cape.

The currents off the cape set to the northward and westward into the Gulf of California and are the most remarkable on this coast; vessels may be set in a good deal and must be on the lookout for them. On the other hand there are many reports of vessels experiencing no currents in this vicinity.

Ysatan Point, about 3 miles eastward of Cape Corrientes, is a grayish rock point, a sand beach intervening between them. It appears to be the farthest projecting point on almost any line of approach, and may be easily mistaken for Cape Corrientes.

Coast.—From Cape Corrientes the coast line trends about southsoutheast for 6 miles, with low yellowish rock bluffs on the intervening white sand beach, and then about southeast to Ypala Point.

Cucharitas Rocks.—At this turning point in the shore is a group of low rocks on the beach called the Cucharitas, with a low reef extending in a southwest direction about 1 mile from the beach. The highest rock of this reef is only about 3 feet above water, and the breaks on and around it can be seen 6 or 8 miles.

If Corrientes be passed close-to, the Cucharitas will shut out Ypala Point.

Ypale Point, when sighted off the cape, stands out as a moderately high and bold-faced rocky bluff of grayish color. It is about 7 miles from the Cucharitas Reef, the coast between being an unbroken white sand beach. There are no cutlying dangers off this point, the only rocks being on the west side and within the tangent to its extremity.

Anchorage.—On the southeastern side of the point, where the sand beach begins, is a cove where small vescels can anchor in about 5 fathems of water and find shelter from all but southerly and southeasterly winds. Care should be taken not to run too near some sunken rocks that lie about 30 yards from the beach near the left center of the cove. Larger vessels may anchor farther out, in 10 fathems, good holding ground, about ½ mile from the beach, with the white house bearing 102°. Vessels load here with logwood, etc.

The landing is bad except in the cove, where the natives have two or three canoes moored.

Village.—About 1½ miles eastward from the point, indicated by a low place in the shore range of hills, is the closed mouth of a lagoon and near it a small village lying away from the beach and hidden by the trees. About 500 yards to the left of the lagoon and 150 yards from the beach stands a white adobe house among the trees; this is the only structure visible from the anchorage.

Supplies.—Eggs, chickens, and such produce can be obtained from the natives in small quantities.

Coast.—From Ypala Cove the coast trends about south to a rocky point about 21 miles from Corrientes, the shere being a sand beach with a woody background. This rocky point is low and not remarkable; off it about 200 yards are a few sunken rocks. A high sand beach extends nearly the whole distance from this point to Black Rock Point. At nearly 2 miles from the rocky point is a large legion, the mouth of which is closed except in the rainy season. This lage on appears to extend to the couthward and eastward into a large valley, behind which is a shore range of hills, which contains near its castern end, distant about 3 miles from the beach a pyramid-shaped mountain 916 feet high, easily recognized. About 7 miles

farther is another closed lagoon, 1 mile eastward of the low sandy point that marks the change in direction of the shore line. The surf is heavy along this beach and landing dangerous. A third lagoon lies 18 miles southeastward of the rocky point.

Black Rock Point, about 5 miles from the lagoon last mentioned, is so called from its appearance and the knob behind it; although nearly white from the deposit of gulls and other sea birds, it generally shows black from seaward. The point is a low bluff under a peculiar black knob that forms the western extremity of a shore range of hills extending to the eastward and diverging from the coast. This knob is 655 feet high, and is easily recognized from either side, making a good landmark for the locality of Black Rock. At the end of the sand beach to the northwest of the point there is a stream or lagoon where boats may find a landing.

Black Rock, 1 mile westward of Black Rock Point, is irregular in shape, 35 feet high, and has a low rock just outside and close to it; there are also a few sunken rock close to the inner side. Vessels may pass within ½ mile of the rock without danger.

Coast.—From Black Rock Point the coast trends to the southeastward 3½ miles to a point on the northwest side of which are several huts, and to the right of them is a large lagoon, the mouth of which is not open during the dry season, but seen from seaward appears like a river mouth. In front of the huts and 200 yards from the beach is a low rock 3 feet out of water with sunken rocks near it, upon which the sea breaks. Off the southern side of the point is a cluster of rocks 2 or 3 feet high and there are sunken rocks all around and immediately under the point. Vessels should give the point a berth of at least 1 mile.

From this point the beach continues in a southeast direction nearly 3 miles to a low flat rocky point that extends out 400 yards from the general beach line. When first seen it appears to be a small island, but on a closer approach a short and narrow sand strip is found to join it to a low bank on the shore line.

To the scutheastward of this rock point a sand beach extends about 4 miles, and from the end of this sand beach, just behind which is a closed lagcon, extend bluffs and short sand beaches for 5 miles to the northwest point of Chamela Bay. The first bluff is a short one and is separated by a shingle beach, ½ mile long, from the next rocky bluff point, which from the westward resembles an island and has a group of low rocks outside of it. The shore line then bends in, ferming a shallow bight with three short sand beaches at the bottom, separated from one another by two dark-red bluffs; a group of rocks lies ½ mile south of the first of these bluffs, but within the bight and out of the track of vessels.

Remarks.—From Cape Corrientes to Chamela Bay the water is shoaler than along any other section of the coast, soundings of 45 to 55 fathoms being obtained at 3 miles from the shore, and 20 fathoms at a mile from the sand beaches, where they exist. Vessels may anchor off any of the sand beaches, but this coast is not considered safe between June and the end of November, during which time southeast and southwest gales are prevalent, bringing in a heavy sea.

Punta Rivas, the northwest entrance point of Chamela Bay, is a bold cliff of reddish-brown bluffs, not distinctly marked, with outlying rocks on which the sea continually breaks. The hill over the point rises to a height of 200 feet. From Punta Rivas a chain of rocks extends to the eastward a distance of 600 yards from the land, with 8 or 9 fathoms close outside of them.

Chamela Bay, sometimes called Perula Bay, is the first noticeable indentation of the coast to the southeastward of Cape Corrientes, and is a shallow bight, sheltered by a chain of islands, and extending from Punta Rivas to Flat Top Point, its southeast extremity, with a length of 5 miles and a depth of 1½ miles. During the fine or dry season, from November to June, when the sea breeze, from the northward and westward, is regular during the day and the land breeze at night, the anchorage is perfectly safe in any part of the bay; but during the rainy season, from June until November, gales from the southeast or the southwest are frequent, and occasion heavy seas throughout the bay.

Passavera and Colorado are two conspicuous islands occupying a central position between the headlands. Passavera, the northern island, also called White Cliff Island, is 186 feet high in the northern part, and is remarkable for its perpendicular white cliffs, which are seen from a long distance. Colorado, so named from its reddish appearance, is more regular in shape and lower than Passavera, being 164 feet high. About 300 yards from the southeast point of Passavera and the north point of Colorado is the small islet of Novilla, from which a shoal ridge with 3½ and 4 fathoms on it extends in a northeast direction to the beach.

Cocina is a small round island 110 feet high, $\frac{3}{4}$ mile southeastward from Colorado. To the southward and eastward of Cocina Island are several small islands and islets, the principal of which are San Pedro, San Augustin, Sphynx, San Andres, and Negrita, with sunken and outlying rocks around them.

Entrances.—Between the easternmost rock on the west side of the bay and Passavera is a passage a mile in width, with a least depth of 13 fathoms at 250 yards from the rock, and 11 fathoms less than ½ mile from Passavera. There is also a passage ¾ mile wide, with 14 fathoms in the middle, gradually shoaling toward the shore, be-

tween Colorado and Cocina, leading to the southeastern part of the bay.

Anchorase.—The best anchorage is in the northwest part of the bay, where 6 fathoms of water is found within 500 yards of the beach, with protection from all but southerly winds. Vessels may take a berth according to size and draft, as there is anchorage anywhere within a line from Punta Perula to the north end of Passavera. Small vessels anchoring in the bight get more out of the swell, which is heaviest during the period of full and change.

Vessels wishing to communicate with the village of Chamela can anchor more conveniently between Colorado Island and the beach to the eastward, but this anchorage is more exposed. Small vessels anchor inside of Cocina Island, in 4 to 5 fathoms, ½ mile from the village; inside of this distance it shoals rapidly.

Chamela Village, situated at the southeastern end of the bay, is a port of entry, with the regular customhouse officials. A large white house, standing on a bluff, can be seen a long distance at sea, particularly with the sun past the meridian. A stream of fresh water flows into the bay immediately north of the village and at the base of the bluff on which stands the white house.

Supplies.—Fresh beef, chickens, eggs, and fruit can be had in small quantities by giving a day's notice in the village; excellent fresh water may be obtained. The exports are chiefly hides and dyewoods, the latter of an inferior quality.

Directions.—In approaching Chamela Bay, two prominent mountains lying behind it form excellent landmarks, easily seen and recognized in clear weather at a long distance on either side of the bay. The nearer mountain, Gueguenton, 3,422 feet high, stands about 11 miles 73° from the observation spot at the head of the bay; the other, 4,675 feet high, is 5 miles 60° from Gueguenton; its appearance from either up or down the coast is about the same. To enter Chamela Bay, bring these mountains in range bearing 60° and stand in on this course until near Passavera or Colorado Island, then go either to the north or the south of the islands, according to the anchorage desired.

In approaching from the eastward when the mountains are shut in by haze, smoke, or rainy weather a hill to the southeastward of Chamela in the nearest shore range, 1,265 feet high, with low and yellow bluffs just under it, might be used as a landmark. From the westward, under the same conditions of the weather, Passavera Island will be the mark.

Farallon Point and Anchorage.—To the southeastward of Chamela Point the coast line for upward of 6 miles is a succession of low rocky bluffs, terminating at a sand beach; the easternmost bluff shows a whitish face from seaward. This sand beach curves

around to the southward and from its southern end projects Faralian Point, which is low and rocky, and has just off it a small rocky islet, at a distance resembling a low bluff, with a small rock at its western end. The anchorage in 10 fathoms, about $\frac{1}{4}$ mile from the beach, with Farallan Point distance $\frac{1}{2}$ mile, is fairly protected in the season of southeasterly winds. A clear-cut bluff, resembling a palisade, stands a few yards from the shore near the anchorage. At the southeastern end of the sand beach there is a fair landing for boats.

From Farallon Point the coast line trends southeasterly for 6 miles to a turn, off which lie two remarkable needle-shaped rocks called Los Frailes.

Los Frailes, respectively 75 and 120 feet high, stand out clearly from the land, at times having the appearance of a sail. The outer Fraile is 1 mile from the beach, with deep water close-to and no hidden dangers near it; a few low rocks lie off the southeastern side close to the base, but not in a dangerous position. Vessels may pass the cuter Fraile within 200 yards, if necessary.

The inner Fraile, with three or four low rocks about its base, lies about 1,400 yards from the beach and shows sharper than the outer one; the top is white from the deposits of sea birds.

Inside and about 150 yards distant lies a small low rock, and still further inside, a rock cluster and reef extending nearly to the bluffs. A vessel might pass between the inner Fraile and this reef in case of necessity, but to do so is not safe.

Between the two Frailes is a passage 500 yards wide, with plenty of water and free from hidden dangers.

From the Frailes to Brothers Point, the northwest head of Tenacetita Bay, distant 5 miles, the coast is a sand beach with two rock bluffs breaking it at short intervals. On the east side of the second bluff a lageon emptics into the sea.

Brothers Point is a large bluff headland, 185 feet high, with a remarkable double hill over it, which from the westward has the appearance of an island. Off Brothers Point, and in the vicinity of Squall Point, the next point to the eastward, are many low detached rocks, interspaced with sunken reefs and rocks awash. Vessels should not approach either of these points within ½ mile.

Bird Island, 600 yards southwestward of Brothers Point, is a square perpendicular rock 152 feet high, of reddish-brown color, with whitish top; a lower sharp rock off its south face appears as a part if it.

Porpoise Rock, 1½ miles westward of Brothers Point, is about 12 feet high and lies on a line from the outer Fraile to the inner slope of Navidad Head. It can easily be seen in coming from the westward and appears to lie well out from the bluffs to the westward of Tena-

catita Bay. It may be passed close-to in rounding into the bay, but on no account should an attempt be made to go inside of it, as there are many sunken rocks between it and the shore.

A sunken rock with only a couple of feet of water on it lies 43° off Porpoise Rock, distant 700 yards.

Tenacatita Bay is a large and deep indentation lying between Brothers Point and Navidad Head. This bays contains West Bay and another bight in the northwest rn part and Tamarinda Bay in the eastern part. The water is deep throughout the bay, shoaling gradually from 35 fathoms at the entrance to 10 fathoms at 1 mile from the head. There are no cutlying dangers, with the exception of Center Rock, and vessels of any size may enter with perfect safety and find good anchorage. Detached rocks lie off all the eastern shore of the bay, with deep water close to them.

Center Rock, about 10 feet high, lies in the northwest part of the bay, & mile eastward of Squall Point; it has plenty of water all around and close to it.

Anchorage.—The best anchorage, well sheltered during the rainy season, is in the northeastern part of the bay, off Tenacatita Village, in 10 fathoms of water, about 1 mile from the long sand beach, toward which the water shoals gradually. Vessels of light draft, passing to the eastward and northward of Center Rock, will find in West Bay a good anchorage in 7 or 8 fathoms, sheltered from nearly all winds. Vessels can also anchor in Tamarinda Bay, where the boat landing is better than off the village, but not convenient for loading or discharging cargo.

Supplies.—Provisions can not be obtained here without sending into the interior, and then only beef, chickens, and eggs. Water is precurable near the village, and firewood and coquita nuts and shells are abundant. The latter can be used for fuel in case of necessity; for steaming purposes 3 tons of shells are about equal to 1 ton of coal. In buying these shells it is best to deal directly with the natives.

Navided Head, 400 feet high, is remarkable when seen from any direction. It is a wedge-shaped, high, rocky, narrow chain of islands, projecting \(\frac{3}{4} \) mile straight out from the mainland. The inner large island is separated from the mainland by a narrow and rocky passage, through which boats may, with great caution, pass in a still time. The outer extremity of Navidad Head is the highest part and forms the head proper; when bearing north it has the form of a wedge.

Extending out from the head in a south-southwesterly direction are three large rocks, which are additional marks for Tenacatita, as well as for Navidad Bay, some 7 miles to the eastward of them. The innermost and highest of these rocks is a dark rock just under the

head and is about 115 feet high; as seen from the westward there are two lower sharp rocks on its right.

White Rock.—The second rock, about 750 yards outside the head, is about 100 feet high, rather square in shape, with a pointed or rounded top. The top shows dark, while the middle portion, tapering to the base, shows white from the deposits of sea birds, and is often mistaken for the white islet off Manzanillo.

The third principal rock is only 40 feet above water, and of a dark color; it lies ½ mile outside the head and has several small low rock clusters just outside of it.

Inside the limits of Tenacatita Bay, and nearly opposite the inner end of the island ridge forming the head, lies a group of white rocks which show out very prominently against the dark background when approaching from the westward.

Sunken rocks.—About 200 yards 200° from White Rock is a sunken rock over which the sea breaks at most times. A rock awash lies 400 yards eastward of White Rock, but is out of the way of all vessels.

Coast.—From Navidad Head to the northwest bluffs of Navidad Bay, distant about 6 miles, the coast presents a broken line of rocky bluffs from 50 to 100 feet high; behind the bluffs the country is woody and hilly, rising to a height of 4,000 feet. Four miles eastward of the head is a deep bight on the west side of which are several sharp-pointed rocks, the highest being about 40 feet high. This bight has two short sand beaches at its head, with a small stream coming in on the southern side.

Harbor Point, the northern entrance point of Navidad Bay, is a high, white, projecting point, which, with several detached rocks, forms the shelter or protection for the anchorage with the wind from the southwest.

Navidad Bay, lying between Harbor Point on the north and Graham Head on the south, is about 1½ miles wide and ½ mile deep, with a sand beach at its head. At either end of the beach is a small village inhabited only during the dry season. A small lagoon near the village at the western end of the bay extends to within a short distance of the beach and breaks through during the rains; the water is not recommended for use.

Near the eastern end of the beach another lagoon opens on the bay. There are $1\frac{1}{2}$ fathoms at its mouth, through which a strong current runs, and, though the lagoon is very shallow, it is navigable for boats at all seasons, the natives say, for 20 miles into the interior.

Anchorage.—Navidad Bay affords an excellent anchorage during the dry season, but at other times is not recommended for sailing vessels, as they might have difficulty in getting out with the prevalent southerly winds. Sailing vessels might anchor farther out, but would then be more exposed to the swell.

Supplies.—Beef, chickens, eggs, and fruit can be had in small quantities from the natives by giving a few days' notice. The best oranges on the coast of Mexico are found here at the cheapest rates, and coquita nuts are abundant. In obtaining supplies here, as in all other places in Mexico, it is recommended to deal with the natives.

Graham Head, 700 feet high, like many others on this coast, appears as an island when first sighted at a distance. Cone Rock, a reddish conical rock 280 feet high, lies close under the head on the west side, but is not readily seen at any distance against the background. A rock 8 feet high lies southwest of the head, \(\frac{3}{8}\) mile from the nearest point of the beach. Outside this rock there are no known dangers.

Vessels passing Graham Head should give it a berth of at least ³/₄ mile.

Coast.—A sand beach extends the whole distance from Graham Head to the bluffs at the west side of the entrance to Manzanilla Bay. The country just behind it is low and partly occupied by a large lagoon, remarkable for its bilge-water stench. The wreck of the Pacific Mail steamer Golden Gate lies 9 miles from Graham Head; only a portion of the wreck remains. Boats may generally land on the beach in the fine season, and there is safe anchorage $\frac{1}{2}$ mile from the shore in 18 fathoms.

Piedra Blanca, the principal landmark for Manzanilla Bay in coming from the westward, lies 1 mile southwestward of the junction of the sand beach and bluffs. It is nearly circular in shape and about 1 mile in diameter, but is irregular in outline and height. The highest point, 260 feet high, is on the south side, with all its faces precipitous. From the deposits of sea birds, the island is very white in appearance and is readily distinguished at a great distance. There is plenty of water close up to it on all sides, and vessels can pass between it and the group of rocks off the shore. These rocks, about 5 feet high, lie 1,000 yards west of the bluff, and only about 400 yards off the beach. The country behind the beach at this point rises into low, woody hills, and then into the mountains of Juluapan, on the northwest side of Manzanilla Bay.

Punta Carrizal lies about 2½ miles eastward of Piedra Blanca, and has close off it a remarkable high rock and several other detached rocks.

Manzanilla, Santiago, and adjacent Bays.—Between Punta Carrizal, on the west, and Punta de Campos, on the east, are the bays of Carrizal, Higeras, Santiago, and Manzanilla. The two

largest and most important, Santiago and Manzanilla, are separated by a narrow promontory ending in Punta de Santiago.

Santiago Bay is about 2½ miles wide between the entrance points and 2 miles deep within them; Manzanilla Bay about 2½ miles wide by 2 miles deep.

Cerro Juluapan or Table Mountain, a very remarkable table-topped mountain, rises about 2 miles northwestward of Santiago Bay. Its ends are, respectfully, 2,620 and 2,790 feet high, the outer or seaward end being the lower, and from the southward are in range; the table top shows from the westward or the eastward.

Wreck Cone, a cone-shaped single peak, 1,524 feet high, stands 3 miles southwest from the inner end of Juluapan and about midway between it and Piedra Blanca.

Vigia Grande is a cone-shaped peak, 711 feet high, westward of Manzanillo and overlooking the town. From the eastward it shows as the inner hill of the peninsula, which from this direction appears to be a cape. From the westward the peninsula appears to have cut through the middle; this is called "Las Ventanas," and is not visible from the eastward when close in to the beach.

Vigia Chica, the lookout station for Manzanillo, is 221 feet high and situated close under and to the northward of Vigia Grande.

Sail Rock, so called from its appearance when seen at a distance, is 112 feet high and lies 500 yards off Punta de Campos. Several detached rocks, from 5 to 10 feet high, lie off its south face, and one black rock about 20 feet high lies one-third of the way between it and the point. There is deep water outside of and close to Sail Rock, with no hidden dangers except those shown on the chart. A vessel can pass between the rock and the point, but it is not recommended to do so. Vessels can also pass within \(\frac{1}{2}\) mile of all the bluffs from Sail Rock to the anchorage off Manzanillo, the sunken and detached rocks being indicated on the larger scale charts.

Los Frailes or Sister Rocks.—Lying off Punta de Juluapan, 2[‡] miles eastward from Punta Carrizal, are seven small detached rocks from 5 to 20 feet high. These rocks may be passed close-to on either side, there being deep water close alongside of them.

Pelican Rock, off Punta de Santiago, is of whitish color, 72 feet high and 4 mile in circumference.

Landmarks.—Piedra Blanca, Cerro Juluapan, and Wreck Cone, on the west, Vigia Grande, with its projecting peninsula, and Sail Rock, on the east, are all excellent landmarks in standing in for Manzanillo.

Directions.—After making out any of the landmarks for Manzanillo Bay and getting off the entrance, no sailing directions are necessary, as the way is clear to the anchorage, all dangers showing themselves well above water.

Manzanillo.—The town has a population of about 1,500, is the terminus of the Mexican Central Railway, and is the seaport of Colima, which is the capital of the State of the same name. The railroad dcck extends about 720 feet perpendicular to the water front, and vessels can load and discharge on either side and across the end.

A very substantial breakwater 1,300 feet long, extending outward from the bluff at the west end of the town and in a general north-easterly direction, affords excellent protection for the harbor. A mooring buoy is planted about midway between the end of the wharf and the end of the breakwater. The lighthouse is on the outer extreme end of the breakwater.

The United States has a consul at Manzanillo and also a representative of the Public Health Service. Vessels are boarded by the local health officer.

Manzanillo Breakwater Light is fixed red, visible 10 miles, exhibited at a height of 69 feet from a white crane on the extremity of the breakwater.

Anchorages.—Vessels may anchor anywhere in the vicinity of the breakwater in from 10 to 15 fathoms, good holding ground. The ordinary anchorage, to obtain protection from the breakwater, lies in from 6 to 10 fathoms south of a line running 90° from the outer end of the breakwater. The holding ground is good, and the beach is steep. Gales are not frequent, but at times very severe ones amounting to hurricanes sweep over the bay; the last one, in September, 1912, was extremely severe, but did no damage to shipping. During the dry season gales are very rare.

Climate.—The temperatures from November to April range from 73° to 86° F., and from May to October from 77° to 93° F. The prevailing winds are northwest to west. The rainy season begins in June and ends in November and dry season from December to May. The rainfall is estimated at 60 inches per year. The climate is generally considered as very unhealthy.

There is no sewerage system whatever. The lagoon back of the town has never been drained, and during the dry season the stench from it is said to be extreme. Mosquitos and flies abound. Fevers are prevalent.

There are no hospitals or other accommodations for the sick, the nearest hospital being at Colima, five hours away by rail.

Supplies.—Coal in small quantities is obtainable and it is contemplated to build a large coaling plant. Fresh beef is obtainable on short notice; other supplies are so limited in amount as to be negligible.

Water.—There is no waterworks. Fresh water may be obtained from the Smoot Construction Co. and is brought in tank cars of about 10,000 gallons capacity. Well water is too brackish for use.

Communications.—Manzanillo is connected by the Mexican Central Railway with the State railroads. There is telegraphic communication with the City of Mexico and all parts. The Pacific Mail steamers between San Francisco and Panama call here twice a month each way. It is a port of call for the Kosmos Line and for two South American lines.

Tides.—The tides occur twice in 24 hours; springs rise about 6 feet; ordinary tides rise from 3 to 4 feet.

Currents.—From Manzanilla Bay to Cape Corrientes the current during the survey was found to be variable in force, but always setting alongshore to the northwestward, stronger near the land than offshore, and increasing in strength as the cape was approached. Sometimes no current would be noticed; then, near the full and change, nearly 2 knots per hour.

Colima, the capital and principal city of the State of Colima, has a population of about 19,000 and lies 72° from Manzanillo, distant 35 miles.

It is handsomely built and, like Sacatula on the coast, was founded by Cortes. The climate in this valley is very hot and the soil very productive. The vegetation consists of palms, aloes, and superb orange trees; and above the usual level for these tropical plants are forests of somber pines.

Colima Volcano, 12,745 feet high, is 17½ miles 21° from the city, and is the western extremity of the volcanic chain that traverses Mexico from east to west.

About 3½ miles north of the Colima Volcano, is the extinct crater of Safa Volcano, 14,118 feet high; its summit is usually covered with snow. These two volcanoes may be seen from a great distance at sea, and offer, when the atmosphere is clear, excellent landmarks for navigators approaching Manzanillo.

Punta de Campos is a bluff headland at the southern extremity of the Manzanillo Peninsula.

Punta de Campos Light, flashing white, visible 26 miles, is exhibited at a height of 356 feet from a white wooden tower on a white house. The light has been reported irregular. See Light List.

Coast.—From Punta de Campos to Black Head, distant about 48 miles, the shore line is a gray sand beach, upon which the sea breaks heavily. Anchorage can be had anywhere off the beach except directly in front of the mouth of Cayutlan Lagoon, where, extending directly seaward, there is a submarine valley.

Cayutlan Lagoon, separated from the sea by a narrow strip of lowland on which runs the railroad from Manzanillo, extends for 18 miles inside of and parallel with the shore line.

Rock.—About 18 miles from Black Head and nearly in the line joining Punta Campos and Black Head lies a rock only 5 feet above

water. It is about $3\frac{1}{2}$ miles from the beach, with 15 to 20 fathoms close to it on all sides, and is the only known danger between the two points, lying inside of the line joining them.

Rio Pascuales.—About 5 miles 342° from Black Head, and marked by a line of breakers extending out about ½ mile from it, is the mouth of the Rio Pascuales. Vessels sometimes load here with dyewoods.

Black Head juts out from the mainland, and has the appearance of an island when first seen from the westward or the eastward. It is a cliff 560 feet high, densely wooded from base to top, and is connected with the higher wooded hills on the mainland by a low sandy neck of land $\frac{1}{2}$ mile wide. A small white rock, 75 feet high, lies $\frac{1}{6}$ mile from the northwestern side of the head; an excellent anchorage in 10 fathoms may be found $\frac{1}{4}$ to $\frac{1}{2}$ mile inside of this rock and about $\frac{1}{2}$ mile from the beach. Boats can land on the beach, but there is nothing to be found here. Vessels can pass within $\frac{1}{4}$ mile of Black Head, deep water being found close up to it.

Coast.—From Black Head the coast breaks away and trends southeastward for 12 miles to the Boca de Apisa. At 3½ miles from the head the sand beach is broken by a short line of rocky bluffs; and 2 miles to the westward of the river extends a line of cliffs, backed by a shore range of hills 1,440 feet high.

The Boca de Apisa is surrounded by a narrow line of breakers; the river seems to be a large stream extending back between two shore ranges. Midway between Black Head and Punta Tejupan, about 4 miles from the beach, is a remarkable table-topped mountain; it lies in an east and west direction, with almost level top, the seaward end being 4,030 feet high and the inner end 3,718 feet high.

Three-fourths of a mile southeastward of Boca de Apisa begins a line of low white rocks, 5 to 12 feet high, which extends nearly 2 miles. Two miles west of Punta Tejupan a dangerous shoal and reef makes out from the shore more than a mile, its position being marked at most times by the breakers on it. A line from Black Head to Punta Tejupan barely clears the reef, and vessels from the westward standing in to an anchorage under Tejupan should be particular not to get inside of this line. Between the inshore end of the reef and Punta Tejupan is a line of low bluffs separated from one another by small sand beaches.

Punta Tejupan and San Telmo Point, from either the westward or the eastward appear as one projecting point; from the westward Tejupan apparently projects more, and from the eastward San Telmo; when directly abreast of them there is no point visible, both being in appearance a series of rocky bluffs. Tejupan is the more prominent of the two, owing to the three rocky islets that lie 269° from it and extend for 1,200 yards. The outer one is a black rock about

20 feet high and only a few yards across; the middle islet is 40 feet high and about \(\frac{1}{2}\) mile long; the inside one is 60 feet high and about \(\frac{1}{2}\) mile long. Each is surrounded by sunken and detached rocks, which renders landing difficult and a near approach dangerous. There is an anchorage to the northwestward of these rocks in 12 or 15 fathoms of water, with a low stone pile on the middle islet bearing 135°. There being but little shelter from southeasterly winds, this anchorage is not a good one.

Son Telmo Point Light, group flashing white, visible 21 miles, is exhibited at a height of 225 feet, from a white concrete tower 50 feet high on San Telmo Point. The light is unreliable.

Caution.—During the daytime Punta Tejupan and San Telmo Point can be passed close-to, but at night they should be given a good berth on account of their lowness and the variable current setting along this part of the coast.

Punta Tejupan is low with several large rocks or islets off it. Vessels frequently anchor here in the dry season close inshore and inside of the islets.

Coast.—Between Tejupan and San Telmo the shore line is of rock bluffs, with short white sand beaches adjoining each point.

From San Telmo Point for 2‡ miles the shore line is a succession of rock bluffs and cand beaches, which end in a remarkable sugarloaf rock 75 feet high: then follows a white sand beach 2½ miles long, meeting the low bluffs 3 miles west of Piedra Blanca. These bluffs, increasing in height to Maruata, are separated by sand beaches.

Piedra Blanca, lying only a few yards off the south side of the bluff, is a white rock 110 feet high and about ‡ mile in circumference, and, taken together with the white bluffs behind it on the shore, forms the best landmark for Maruata Bay, which lies ‡ mile to the eastward of the bluff. The bluffs show white to the eastward and are the first high white bluffs to the castward of San Telmo Point.

Maruata Bay is exposed to all winds except those from the northward and westward. On the west side of the bay lie four small rock islets in a line from east to west off the point, extending about in mile. The shore line of the bay is a white sand beach, and the rocky islets, with a rock bluff at the end of the beach, form the western limit of the bay.

Vessels sometimes load here with dyewoods, but no supplies of any kind can be obtained. Water can be had from the lagoon which empties into the western end of the bay, but it should not be taken on board except in case of necessity. The Mexican Government has tried three times to open Maruata to trade by establishing a custom-house here, but the attempt has been abandoned, as it is without doubt the unhealthiest place on this coast.

The anchorage is in 7 fathoms of water, sand over mud bottom, about \(\frac{1}{3} \) mile from the beach, with the eastermost of the four islets bearing 284°. A native hut stands in a grove of cocoa palms back from the main sand beach. Although boats can land on the western end of the beach, it is better to pass outside of the islets and land on the short sand beach to the westward of them, where the water, being out of the heavy swell which sets into the bay, is moderately smooth.

Paps of Tejupan, about 12 miles from the coast, are at the summit of a range about 5,600 feet high, and are not well defined as "Paps." From a vessel to the eastward or westward of them a double-nipple summit appears, the northern one being wooded to the top, while the other is almost bare. They are not distinctly seen from the southward, as they are then overshadowed by the more lofty ranges behind them, which rise to elevations of 9,000 feet above the sea. A smooth wooded cone 2,140 feet high, 3½ miles from Maruata, is remarkable when passing this part of the coast.

Coast.—For 3 miles eastward of Maruata extends a line of high and bold-faced bluffs, backed by woody hills. A low rock reef extends 4 mile in a southwesterly direction off the next to the end bluff. A sand and shingle beach succeeds these bluffs for 31 miles. where begins a high and remarkable bluff line extending 6 miles to Pichilinguillo Bay. This last bluff line is broken by 3 or 4 projecting points with detached outlying rocks off each, but from Punta Tejupan to Lizard Point the water is deep close to the bluffs, and a vessel can pass within ½ mile of each one. All dangers show themselves above water in low outlying rocks. Westward of Pichilinquillo, 24 miles, the bluffs are vertical and even overhanging, from 50 to 120 feet high; the sea faces of them are perfectly smooth, and a vessel might brush against them, the water beeing deep and free from danger close to their bases. Near the center of these vertical bluffs a small stream flows over the face of the cliff, leaving a yellowish-white deposit, which shows a long way at sea.

The whole country between Maruata and Lizard Point is broken, mountainous, and densely wooded, rising in successive ranges until an elevation of 9,000 feet is reached 15 or 20 miles inland. About 5 miles to the westward of Pichilinquillo are two small sand beaches between the bluffs, where fresh-water streams empty into the sea.

Pichilinquillo Bay lies to the westward of Lizard Pcint, with a white sand beach at the head. It is open to all southerly winds, yet affords good anchorage for small coasters. Three-quarters of a mile from the western side of the bay, and on a line with Lizard Point, lies a rocky islet 100 feet high and about ½ mile in circumference. It is not easily distinguished as an island unless close in with the coast.

Between this islet and the sand beach inside of it are a great many sunken rocks, through which it would be difficult for a boat to pass; there are also two sunken rocks on a line between it and the bluff point on the west, one about midway and the other close to the point.

Large vessels can anchor in 9 or 10 fathoms, sand bottom. on a line from the islet to Lizard Point; smaller ones can go into 5 or 6 fathoms, 1 mile from the sand beach, and find better shelter. Nothing in the way of supplies is found here, and there are no signs of habitation anywhere near the bay.

Lizard Point, which forms the eastern side of Pichilinquillo Bay, from either up or down the coast appears low. narrow, and projecting; it is a dark, bluff headland, 1.1 miles long on its sea face, about 100 feet high, and covered with thick woods.

There are several outlying rocks close to Lizard Point, but a vessel may pass within ½ mile of them.

Coast.—From Lizard Point the coast extends for 25½ miles to a low, bluff, rock-faced, and not remarkable point, which projects ½ mile beyond the general bluff line. There are many low outlying detached rocks off these bluffs, but all are close in and out of the track of passing vessels.

Bufadero.—Three miles west of this low point is a reddish bluff with a bufadero in it, a jet of water or spray being forced by the action of the sea through the crevice of the rock below, resembling the spouting of a whale.

Landing.—At 61 miles to the eastward of Lizard Point a fine, rapid stream empties into the sea on the east side of a low shingle point of the beach. A palm grove stands on the west bank, and the landing for boats is fair when no sea is running.

Coast.—At 18½ miles east of Lizard Point is a remarkable peak when seen from up or down the coast. It is sharp at its summit, 1,443 feet high, and descends in a long saddle-like slope to the outer extremity of the ridge, which terminates in a decided knob, 960 feet high. The highest peak is 1,800 yards from the shore line, which is here a low bluff, 1,800 yards long. From the outer peak or knob a gentle slope descends to the shore line, and the low extreme point, 7 miles to the eastward, shows as a prolongation of the slope, appearing at a distance from up or down the coast as a low point extending out from the knob. There is a large river, with a line of breakers across its open mouth, lying between this knob and the Bufadero Bluff.

From the extreme bluff point, 3½ miles east of Bufadero, the coast line trends about east for 11½ miles to the end of the bluff line and the commencement of a long unbroken sand beach extending around Mangrove and Sacatula Points.

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Along this coast are frequent high-water breaks, indicating mouths of streams during the rainy season. There are many detached rocks off the little bluffs, but they are close to the beach, and may be approached to within ½ mile without danger. The country behind this coast is rough and mountainous.

Anchorage.—Vessels may anchor anywhere off the sand beach in from 10 to 15 fathoms, $\frac{1}{2}$ to $\frac{3}{4}$ mile from the shore; the sea breaks heavily all along the beach.

Calpica Village is $5\frac{1}{2}$ miles down the beach from the end bluff, with two small groups of huts between it and the bluffs. About 9 miles from Mangrove Point is another village of 15 or 20 huts, on the east side of the closed mouth of a lagoon.

Mangrove Point is a low round point, 20 to 30 feet high, formed by the change in direction of the shore line. It is covered with mangroves and palms, and, near the point, with dead trees and brush. There is nothing to mark this locality, as the country behind it is low and flat, forming the delta of the Sacatula River.

Sacatula Point, distant 3 miles 68° from Mangrove Point, is near the principal mouth of the river of the same name, and is the northeastern end of the delta, while Mangrove Point is the southern end. Together they form a single round-shaped point.

Sacatula River, one of the longest and largest rivers in Mexico, rises in the mountains near the City of Mexico, and discharges into the sea through three mouths, the first and largest being near Sacatula Point, the second 6 miles, and the third 8 miles west of Mangrove Point. This river is known to the natives under three different names: Sacutala, near its mouth or in the delta; Balza, from the head of the delta for some distance inland; and Mescal, thence to its headwaters. During the rainy season an immense volume of water is discharged into the sea, discoloring the surface for some 8 or 10 miles offshore.

The soundings of the delta of the Sacatula are very irregular, 17 fathoms occurring in one case at $2\frac{1}{2}$ miles, and 225 fathoms at less than 2 miles from the shore; the bottom is of shifting sand and discharged mud.

Anchorage.—Vessels can anchor anywhere off this beach, the deeper and safer water being to the westward of Mangrove Point. There is no landing in either of the mouths of the Sacatula.

Petacalco Bay.—In this bay, as to the southward and eastward of it, the bottom is very uneven and lumpy. Vessels should approach the shore with great caution, as the bottom is shifting and the soundings on the chart, close-in, are not reliable for any length of time.

Canuta.—There is an excellent boat landing at Canuta, on the west side of Petacalco Bay, but nothing in the way of supplies can be obtained.

Coast.—From Canuta the coast trends southeastward 23 miles to Punta Troncones, a low cliff headland, 540 feet high, rising to a peak behind it, 1,145 feet high. The beach is low, covered with cocoa palms, and broken in a number of places by small streams which drain the adjacent country during the rainy season. The water is deep close to the beach, and anchorage can be had only in Salada Bay, 1½ miles west of Punta Troncones. From this point the coast trends southeastward 8½ miles to Istapa or Isla Grande Bay.

Isla Grande or Istapa Bay.—An excellent harbor of refuge is formed by Isla Grande and the mainland, protected from all winds except those from west-southwest to west-northwest, which seldom or never blow. About a mile to the northward of the bay is the Rio Rincon, which, like the Sacatula and most other rivers in Mexico, is closed by a bar with heavy breakers on it; but boats can cross this bar without much danger by selecting a smooth time. A small Indian village lies about 5 miles up the river, where an excellent quality of fresh beef can be had but no other supplies.

A sunken rock lies about ½ mile 353° from the north point of Isla Grande, with only 5 feet of water on it at low water; with a heavy swell and at low water it breaks, but at other times its position is not indicated. By passing close to the islet off Isla Grande, say 400 yards, this danger may be easily avoided when approaching or leaving the anchorage.

Anchorage.—Vessels may anchor anywhere after passing a line from the outer rock off Isla Grande to the Rio Rincon, but the deepest water is near Isla Grande. There is apparently a free passage, with a depth of 2‡ fathoms between Isla Grande and the mainland, all dangers showing above water. Tides rise 2 feet, approximately.

Isla Grande or Istapa Island is small and of irregular shape, about 170 feet high, and $\frac{1}{5}$ mile from the mainland. It is thickly covered with brush and undergrowth. When seen from the offing it has not the appearance of an island, but looks more like a headland of the coast.

Isla de Apies, 1 mile southeastward of Isla Grande, is 216 feet high, heavily wooded, and connected to the mainland by only a narrow sand strip about 3 feet above the water. This island forms with Isla Grande a bay open to the southwestward, where anchorago can be had in 6 fathoms; but the bay is not so good as that north of Isla Grande.

San Juan de Dios Bay, to the eastward of Istapa Point, is foul, being cut up by a group of recks or islets called Islas Blancas.

Islas Blancas are six or eight detached rocks from 20 to 150 feet high; the easternmost and largest is less than 1 mile in circum-

ference and quite square in shape. They are very conspicuous from the offing, particularly when the sun is past the meridian; with the sun shining on them they have a white appearance, but at other times, or on an overcast day, they are dark brown in color. Vessels can pass within ‡ mile of them in safety.

Coast.—Isla Grande is the westernmost elevated ground in the immediate vicinity; the coast to the eastward is bold and rocky, the bluffs coming down to the water. About 4 miles from the peninsula is the first bluff point, 2 miles farther the second, 1 mile from the second the third bluff, and ½ mile from this still another; then the rocky beach breaks away to the northward and eastward about 2 miles to the sand beach.

Sihuatanejo Bay lies between the second and third bluffs, 6½ miles from Istapa Point, and is a small but excellent harbor, free from all dangers, and easy of access, with deep water close to the rocks on either side of the entrance. The harbor is open to winds from the southwestward, but affords anchorage anywhere inside the bay, with allowance for the draft of vessel and the heavy swell that sets in from the sea. At the entrance are soundings of 17 fathoms, decreasing gradually to the head of the harbor. The holding ground is good, the bottom soft mud. The land all around the bay, except at the head, rises abruptly from the beach. Directly behind the harbor are two remarkable peaks. Tides rise 2 feet, approximately.

Supplies.—Excellent beef and water can be obtained here, but no other supplies.

Black Rock, or Solitaria. 46 feet high, lies 1 mile off the entrance to the harbor and is the only good mark for it. Between the rock and the entrance the bottom is gravel and stone.

Directions.—Coming from the westward, after passing Mangrove Point, steer about 115° 35 miles for Islas Blancas; pass outside of them and on getting nearer Black Rock will be easily distinguished. Coming from the eastward, after passing the White Friars, steer 323° for Black Rock, which may be passed within 200 yards on either hand, there being from 5 to 10 fathoms within a boat's length of the break at its base. On nearing Black Rock from the southward the sand beach to the right and in the harbor can be seen, but the huts at the head of the bay do not show until quite well in.

It should be remembered that Black Rock is the mark for Sihuatanejo Bay; without getting hold of the rock there may be trouble in finding the bay, while with it close aboard, one can not miss or mistake the entrance.

Morro de Petatlan, about 640 feet high and ½ mile in diameter, is a round hill jutting into the sea, and densely covered with bushes and straggling trees; at a distance, either east or west, it appears

as an island, being connected with the mainland by a narrow neck of land thickly covered with undergrowth. The point can be approached within 1 mile, as the water is deep close-to, and all rocks and dangers show themselves.

Petatlan Bay.—To the northward of Punta Gorda is the bay or roads of Petatlan, sheltered from all winds except those from the southwest to northwest, affording anywhere just iuside the point an excellent anchorage in 5 to 10 fathoms, hard sand bottom, shoaling gradually to the beach. On the north side of the morro is a straight and abrupt shingle beach; at the end of the shingle and the commencement of the sand beach, there is an excellent boat landing. There is an abundance of very good edible fish in the salt lagoon at the head of the bay, but there are no supplies to be had, nor is there any fresh water in this vicinity. Tides rise 2 feet, approximately.

White Friars, or Potoci Rocks, are a cluster of 12 barren rocks or islets white with bird deposits, lying between 1 mile and 1½ miles west of Morro de Petatlan, with deep water close-to. Four of these rocks are quite large and from 150 to 200 feet high; the others are small rocks, the westernmost being 25 feet high. There is an excellent passage between the rocks and Petatlan, with 11 to 20 fathoms of water, the deeper water being nearer the rocks.

Coast.—From Petatlan the beach forms an unbroken line for 17 miles to Japutica Point. This unbroken sand beach is low and covered with bushes, palms, and coconut groves. Behind the beach the land is cultivated and rises to elevations of from 2,000 to 4,700 feet in the mountain range, 10 miles from the coast.

Japutica Point, low, black, and rocky, is easily recognized, as it is the only rocky projection on this immediate coast. To the northward and westward of Japutica the coast recedes a little, and vessels may anchor here. About a mile east of Japutica Point there is a remarkable sand patch 300 yards back from the beach and extending up the bank 75 to 100 feet; it is bright, clear, free sand, surrounded by bushes, and a little to the eastward of it is a large coconut grove. The water is deep close to the beach, but breakers have been seen off the extreme point of Japutica during a heavy blow, although no hidden dangers at any distance from the rocky beach have been found.

From Japutica the sand beach continues in a gentle curve for 9 or 10 miles to Morro de Papanoa.

Morro de Papanoa is a bold rocky headland, 527 feet high, densely covered with brush and small trees. There are several detached rocks off its western face, but to the southward it is bold and clear, and a vessel can pass within ‡ mile of the beach.

Tequepa Bay, to the northward of Punta de Papanoa, affords excellent shelter from all winds except those between southwest and

northwest. A good boat landing is found at the head of the bay, but neither water nor supplies of any kind can be obtained. Tides rise 2 feet, approximately.

Morro de las Animas, a large white rock with several smaller rocks around it, lies 3 miles northward of Punta de Papanoa. Animas is fan-shaped, about ½ mile in length and 112 feet high, the highest part being at the south point. There is a clear passage, with 3 and 4 fathoms of water, between Animas and the mainland.

Rio Coyuquilla enters the sea 1½ miles westward of Animas Rock. The small stream 9 miles east of Morro de Papanoa is the San Luis River, which breaks through the beach only during the rainy season. The land behind Morro de Papanoa is very high and thickly wooded.

Coast.—To the eastward of Morro de Papanoa are three bluffs or projecting points; the easternmost, 3 miles from Morro de Papanoa, is at the commencement of the long sand beach which trends eastward without interruption, except in the rainy season, when streams break through, for 70 miles to the heads of Acapulco; it is from 10 to 15 feet high and crowned with a heavy undergrowth of bushes interspersed with cocoa and other palms. The land behind the beach is low and cultivated, then rises in successive mountain ranges until it attains a height of 12,000 feet, 28 miles from the beach, beyond the Paps of Coyuca.

Between Morro de Papanoa and the heads of Acapulco a vessel can approach the beach to within $\frac{1}{3}$ mile and anchor anywhere in from 10 to 15 fathoms about $\frac{1}{2}$ mile from the line of breakers, just outside of which are 6 fathoms of water. Boat landing is almost impossible on this beach, as there is always a very heavy surf.

Paps of Coyuca are two remarkable conical summits, about a mile apart, of a mountain 26 miles from the coast. The southeastern pap is 10,474 feet high and rises about 1,200 feet above the mountain proper; the northwestern pap is 20 feet higher. This mountain and the high ranges near it are generally covered with clouds, particularly near and during the rainy season; they are clearest early in the morning.

To the northward and westward of the paps, and nearly 30 miles from the beach, is a remarkably high range of mountains, some of which have elevations of 12,000 feet.

Acapulco Harbor is considered the finest in Central America or Mexico, and, for its size, one of the most complete in the world. The bottom is sand over clay, and affords good holding ground. The width is a little over a mile at the entrance but increases within to 3 miles, with depths of 24 to 7 fathoms. All around the harbor are high mountains, which afford considerable shelter and may be seen a great distance at sea. The harbor is infested with man-eating sharks.

Roqueta or Grifo Island, just outside the western entrance point, is of irregular shape, nearly a mile long, cast and west, and 350 feet high. At its eastern and its western extremity a reef, partly above water, extends seaward nearly 300 yards; otherwise the island is clear of any known sunken dangers. A small pier with a depth of 10 feet at the outer end is situated on the north side of the island. El Morro, a small islet or rock, 50 feet high, lies immediately north of the northeast point of Roqueta, with a depth of 15 fathoms close-to.

Rock.—At \(\frac{1}{3}\) mile eastward of El Morro is a rock 5 feet above water, with depths close-to of from 10 to 12 fathoms, in a position dangerous to vessels coming from the westward; the sea always breaks over it, and it is thus well marked by day. There is no passage between the rock and Roqueta.

Roqueta Island Light, flashing white, visible 27 miles, is exhibited at a height of 377 feet from a square white wooden tower with dwelling adjacent on the summit of Roqueto or Grifo Island.

Boca Chica, between Roqueta Island and the mainland, is 250 yards wide in its narrowest part, with a depth of 14 fathoms in midchannel. Vessels using this channel have only to keep clear of the rocks that show; there is no hidden danger.

Boca Grande, the main entrance to the harbor, between Roqueta Island and Bruja Point, is clear of danger, except the rock before mentioned, between which and Bruja Point there is a passage over 1 mile wide.

Lo Serieuse Shoal is covered by 15 feet of water and lies 1,100 yards 79° from Fort San Diego, midway between the fort and the San Lorenzo Rocks; it is the only hidden danger in the harbor.

San Lorenzo Rocks, ½ mile westward of Farallon del Obispo, are a chain of rocks extending ½ mile from the shore, with 6 fathoms of water on the seaward side.

Farallon del Obispo is a rocky islet, 102 feet high, in the northern part of the harbor, near the shore. The depth on the seaward side of this rock is 7 fathoms. It is of a light-gray color, with darker patches.

The city of Acapulco, situated on the low ground at the western end of the harbor, is poorly built, only a few of the houses having more than one story. There is one large church, a conspicuous clock tower, a fair market house, and a small plaza near the center of the town. The population numbers about 6,000, mostly of mixed blood, the Indian and Negro races predominating. There are a few Europeans, who carry on most of the exporting and importing trade of the place. Acapulco was at one time subject to severe earthquakes, but of late years they have been few and not very destructive.

Fort San Diego is marked by a conspicuous flagstaff, and there is a small flagstaff at the inner end of the town pier.

The United States is represented by a consul and a vice consul.

Climate and health.—The rainy season, which is very severe and a great drawback to the prosperity of the town begins about the end of June and lasts until the end of October. Owing to the immediate vicinity of a lofty chain of mountains that overlook the town, the fall is heavy and almost incessant.

During part of the dry season the air is filled with a putrid effluvia from a morass to the castward of the town; this, together with the heat of the sun's rays on the granitic rocks which environ the town, renders it especially unhealthful to Europeans. A cut has been made in the rocks to the westward of the town to let in the sea breeze, which has tended to improve the town's health. The heat during the latter part of the dry season becomes intense, the thermometer rarely falling below 98° F.; water becomes scarce and, as the streams run dry, it is necessary to depend upon wells for water, which is not always good. There is no system of underground sewerage. Acapulco rarely escapes a visit of pernicious fever once a year, usually during the latter part of the rainy season.

Piers.—The pier south of the customhouse pier is roofed, while the customhouse pier is not, and the latter 300 yards northward is liable to be overlooked. The coal wharf is distinguished by a red-roofed house near its inshore end, and the coal shed marked "Welsh Coal Depot." Eastward of the latter pier, about 200 yards, projects the railroad fill. The railroad is in the course of construction. Ships' boats may land at either the customhouse pier or the one southward of it.

Anchorage.—The best anchorage is in Santa Lucia Bay, off the town, in about 10 or 11 fathoms of water, with Fort San Diego bearing 11°, distant ½ mile; the vessel will then be abreast of the low-land, called the Manzanilla, between the bay and the sea to the westward, and thus secure the benefit of the sea breeze, which blows across this neck of land. The advantages of this berth may be further increased by running out a hawser to the rocks just north of the anchorage and bringing the ship broadside to the wind. There is a mooring ring in the largest and outermost of these rocks.

Between the rock to which vessels moor and the adjacent point is a passage which may be used by ship's launches, but there is a rock awash near the point and a submerged rock near the rock where the light is shown which should be first located.

The sea breeze blows quite freshly from about 11 a.m. until after sunset. The land breeze comes from the northward and eastward during the night, but is always very feeble and dies out about sunrise.

Tides.—High water, full and change, is at 2h. 40m.; springs rise 2 feet; neaps, 1 foot. The tidal streams are weak.

Acapulco Harbor Lights.—There is a fixed red light shown from the head of the customhouse pier and one from the pier southward. A fixed white light is shown at the inshore end of the customhouse pier. A fixed red light from Las Dos Piedras of the northern point of Santa Lucia Bay.

Supplies.—The market is well supplied with fresh provisions, and fruit is excellent and abundant. No naval stores of any kind can be obtained. The water obtained at Acapulco is neither fit for drinking nor for use in water-tube boilers.

Coal of good quality can always be obtained; about 5,000 tons Cardiff and 3,000 tons Australian is the average supply. The Pacific Mail S. S. Co.'s coal dock is on the eastern side of the harbor, just inside Point Guittaron. The coal is sent off in small bags in 50-ton lighters; about 150 tons can be obtained in a day. Labor is plentiful, but unless vessels tow the lighters off by their own boats the charge for towing is heavy.

Repairs.—The Pacific Mail S. S. Co. maintains a small floating machine shop, where slight repairs can be effected, but no work of an extensive nature.

There is a marine railway of 800 tons capacity just inside Point Guittaron.

Pilots.—All vessels are signaled to the port from the semaphore station, westward of the town, and pilots will go out to bring in vessels, but do not cruise off the harbor. Pilotage is compulsory for merchant vessels.

Commerce.—The exports are hides, fruits, a small amount of cabinet woods, and silver, mostly coined. Almost all of these articles go to the United States. The imports are manufactured goods and coal.

The customhouse is at the water's edge, near the short sand beach, in front of the town, where all imports other than coal must be landed. Nobody is allowed to work in boats, lighters, or vessels except the men of the matricula of the port, who work under the immediate command of the official who has control of all loading and unloading. A vessel having 1,800 tons of coal discharged it in 30 days.

Acapulco serves as a distributing center for the State of Guerrero; but its commerce is not of any great importance, owing, probably, to the sterility of the neighboring country and the absence of good roads.

Salutes.—Acapulco is a saluting port.

Communications.—The mail leaves every day for the interior and the City of Mexico. The Pacific Mail steamers call here, taking

the mails for San Francisco, Panama, and intermediate ports. The Kosmos Line, between Hamburg and San Francisco, calls each way. It is also a port of call for the through steamers of the two South American lines, and one of the terminal ports for the coast steamers of these lines. There is telegraphic communication with the City of Mexico, and thence to the United States and Europe.

Directions.—The heads of Acapulco are the only rocky projections breaking the sand beach from Tequepa Point on the west to Acamama Point on the east, a total distance of nearly 140 miles. In making Acapulco from the southwestward or southward the entrance is remarkable from the yellowish cliffs of Diamante Point; these and Roqueta (Grifo) Island can be seen at a long distance. The wooden lighthouse tower on the summit of Roqueta (Grifo) is a mark, and the harbor is further indicated by the lofty promontory, which maintains its height and abruptness to the sea. This high land is covered with trees and shrubs and everywhere presents a green surface, except that where it meets the sea its face is laid bare, and shows only white and gray cliffs of granite, not of a massive character, but splintered in all directions.

Entering by the Boca Grande a vessel can use Farallon del Obispo Rock as a leading mark through mid-channel until nearly abreast of Grifo Point; she may then haul up for the anchorage. As there is deep water close to the rocks near this point, with no outlying dangers, a vessel can pass very close to it.

Current.—Off the heads of Acapulco, and for some distance eastward, a current sets east by south, with a velocity of from $\frac{1}{2}$ to 3 knots an hour. In leaving Acapulco for the southward and eastward this fact should be remembered, and at night or in thick weather a course should not be steered to the eastward of 132° until well clear of the sandy point off Papacayo Lagoon.

Diamante Point shows as an island, at a distance of 7 or 8 miles, the land being low at the head of Port Marques, of which it forms the southern entrance point. A reef extends a short distance from the point.

Port Marques, between Bruja and Diamante Points, is a little bay with soundings of from 5 to 20 fathoms, sticky bottom, in which there is good shelter from all except westerly winds. There is a small rock on the northern side of the bay about 200 yards from shore, and at the head of the bay is a sunken rock; these dangers can be easily avoided.

There is under construction a small marine railway and a small wharf with a depth of 10 feet alongside.

Rodrigo Point, 1 mile 124° from Diamante Point, has 100 yards off it a small outlying rock with 13 fathoms of water on its seaward side.

Rocky Point, ½ mile 112° from Rodrigo Point, is the southeasternmost point of the heads of Acapulco. A rock, 10 feet above water, lies off this point, and outside it is a rock nearly awash, with not more than 5 feet of water over it, marked by the curl of the breakers on it.

Coast.—From Rocky Point the coast is an uninterrupted sand beach, except where lagoons break through in the rainy season, for nearly 60 miles to the rocky point of Acamama or the Cerro del Coacoyal. A heavy surf breaks and there is no beat landing along this entire beach, which is low, sandy, and crowned with low bushes interspersed with coconut and other palms. The country inland, low and cultivated to the fcothills, rises to mountain ranges from 1,200 to nearly 6,000 feet high.

Anchorage can be had anywhere along the beach in 10 to 15 fathoms, good holding ground.

Papagayo Lagoon and River.—About 16 miles eastward of Diamante Point there is a low sandy point covered with green bushes, with very heavy breakers off it; the entrance of Papagayo Lagoon and River, with a bar across it, is eastward of this sandy projection. The lagoon and river send out a great deposit, which the wash of the sea adds to the sandy point, causing it to grow year by year.

During the rainy season and for a time after its close, until the neighboring country is drained, this lagoon breaks through the beach and its discharge discolors the sea for miles off the coast, making a good mark for the entrance to Acapulco, especially if a vessel is close inshore and without observations. The beach may be approached within a mile if necessary off the sandy point westward of the lagoon entrance, although a heavy surf and breakers extend some way out.

The remarkable Corcovado Peak, about 20 miles 28° from the mouth of the lagoon, makes an excellent mark, when not obscured, for vessels from the eastward bound to Acapulco.

Nexpa village, 21½ miles eastward from Papagayo Lagoon mouth, is a small collection of huts on the beach, and though small, is the largest along this coast. Just eastward of the village is the mouth of the Nexpa River.

Cerro del Coacoyal, behind Acamama Point, rises gradually from the beach to a mound 626 feet high.

Acamama Point, at the extremity of the long sand beach stretching to Acapulco, is low and rocky, with two or three detached rocks off it to the westward. A heavy line of breakers extends in a southeastward direction for upward of a mile off this point; in the extreme edge or end of the breakers, 4 and 6 fathoms of water were found during the survey of this part of the coast. The surf broke so heavily that the steam cutters could not go in to ascertain the depth and whether the breakers were caused by rocks or a shoal.

Bay of Dulce.—From Acamama Point the coast sweeps around to the northward and eastward for 4 miles, then to the southward and eastward for 41 miles to the Dulce River, forming the Bay of Dulce.

The Dulce River, on the banks of which lies the village of Teconapa, discharges large volumes of water and mud during the rainy season, forming a shifting bottom off its mouth; consequently, soundings are irregular and changeable. A shifting bar across the mouth can only be crossed by boats or lighters at certain stages of tide and swell; the depth over it is 6 feet at low water; the rise and fall of tide about 7 feet.

At the full and change of the moon there is always a heavy swell setting in from the southwestward, cutting off all communication with the river and village.

Supplies.—There is excellent hunting and fishing up the Dulce, which can be ascended 15 or 18 miles in ships' boats, or in canoes obtained at Teconapa. Beef of a fair quality can be had, and water is obtainable well up the river, but it would be difficult to raft the water over the bar.

Coast.—From the Dulce River the coast trends about southeastward 14 miles in an unbroken sand beach to Maldonado, off which about 3 miles lie the Tartar Shoal.

Maldonado Point, or Punta Escondido, is a fairly well-defined point, but can not be made out from the westward except when close inshore, and when coming from the eastward disappears after passing the bearing 337°. A small bight lies close under and to the westward of the point, where there is a good boat landing, and 1 mile to the northward of the landing is an abundance of fresh water.

To the westward of the point is a sandy beach, and for a distance of 6 miles a series of sand bluffs from 200 to 300 feet high, with ravines between them, which are good landmarks at certain seasons.

To the eastward for a distance of 2 miles, the coast is rocky, with the exception of two small breaks where there is a sandy beach, and within a distance of 1 mile from the point are several sand cliffs about 250 feet high, which are prominent and show white from the southward. The entire country in the vicinity of the point is from 300 to 400 feet high and thickly wooded.

At the close of the dry season the forest fires, which everywhere prevail, produce so much smoke as frequently to obscure all the higher land, and also that near the coast, so that a stranger would be apt to greatly overestimate his distance from the shore: with the rising sun the shadow cast beyond the line of breakers also makes the beach appear much more distant than is really the case. These facts should be remembered by navigators.

Tartar Shoal, off Maldonado, constitutes the greatest danger to navigation on this portion of the coast. This shoal consists of

rocky patches, with 1½ to 4½ fathoms of water over them, lying within the bearings 202° and 247° from the point, and distant 3 miles. Outside of these patches the depth is very irregular to a distance of 4 miles from the point, and thence increases gradually in a westerly direction, and much more rapidly in a southerly direction.

A series of shoals extends also northwestward from Maldonado for a distance of 2 miles, and on the outer one, at a distance of 1.4 miles 290° from the point, is the wreck of the Pacific Mail steamer City of San Francisco. The shoal is gradually growing about the wreck by the action of the sea, and heavy breakers extend \(\frac{2}{3}\) mile outside the wreck on a line with it and the point.

Maldonado Point Light, group flashing white, visible 15 miles, is exhibited at a height of 98 feet from a wooden tower 19 feet high. This light has been reported unreliable.

Caution.—Vessels passing along this dangerous part of the coast should keep the lead constantly going, and not venture within the 20-fathom line without knowing well their position.

Landmarks.—The white cliffs or bluffs, the only ones along this coast, which lie behind Tartar Shoal, are the principal marks for it. In passing Maldonado at a distance of 7 or 8 miles from the land, no point, bight, or hook can be distinguished, the whole coast appearing as one beach or line; but close in, within or near Tartar Shoal, the two points of Maldonado can easily be made out; a ship, for safety, should never be that close to this shore.

When well outside of the shoals, say 6 or 8 miles, a second range of hills will show above the shore range or beach bluffs. If this back range is not visible, the weather being clear, the ship is too near the shoals for safety. As it is impossible during the smoky time to distinguish objects on the land at a distance of 5 miles, navigators should shape their course so as to pass Maldonado at a distance of not less than 8 miles.

Tides.—High water, full and change, is at 2h. 45m.; springs rise about 4 feet.

The current sets between 101° and 157° at from $\frac{1}{2}$ to 2 knots, and is strongest on the ebb tide, 101° . Close in to the point the flood sets to the northward and westward.

About 6 miles 225° from the point very heavy tide rips have been observed, the water curling up to the point of breaking. The U. S. S. *Tuscarora* sounded through, in, and around the rips, but the least water found was 18 fathoms.

Between Mangrove Point and Maldonado the current is supposed to set to the southeastward and eastward during the winter months and to the northwestward and westward during the summer, when southeasterly winds prevail, varying in force with the strength of the wind. The greatest current is found off the heads of Acapulco, setting about 112° from $\frac{1}{2}$ to 2.3 miles per hour. This current is influenced by the wind and is more rapid on the ebb tide.

The tides are regular; the ebb setting to the southward and eastward and the flood to the northward and westward inshore. The rise and fall is about 4 feet at Maldonado and decreases gradually to the westward, until at Mangrove Point it is only about 1 foot.

At and near the full and change of the moon there is always a heavy swell setting in on the beach from the southward and westward, decreasing as the moon quarters.

Anchorage may be had to the northward and westward of Tartar Shoal in 6 or 8 fathoms, sandy bottom, anywhere along the sand beach. If intending to land, it is better to anchor near the wreck and Maldonado Point.

Coast.—From the bluffs of Maldonado a white-sand beach extends for 49 miles to the mouth or bar of the Rio Verde. This long sand beach, which is steep-to and surmounted by palms and low bushes, is broken only twice by low rocky bluffs.

Immediately eastward of and behind the Maldonado Bluffs is an extensive low plain, well cultivated for this part of Mexico, with a few villages on it, and near the beach a large lagoon. Forty-five degrees 24 miles from Maldonado Light stands quite a remarkable fort or castle-like mountain with a cone-shaped turret at each end of the ridge, the cone on the left being 3,453 and that on the right 3,833 feet high, and the ridge about 6 miles long. This mountain makes an excellent mark for Tartar Shoal if coming from the eastward in clear weather. During the months of April, May, June, and the first part of July the atmosphere is at times so smoky and hazy that at 2 miles from the beach it is impossible to see and distinguish objects on shore.

Anchorage may be had off the beach to the eastward of the bluff in 7 to 10 fathoms; the bottom is of coral and rock, and uneven.

About 7 miles eastward of Maldonado Point is a village, and 11 miles farther another village near a small bluff and an outlet to a lagoon. Five miles to the eastward of this bluff are four or five rocky bluffs of whitish color, 50 to 75 feet high, with two or three small rocks to the southward and westward, $\frac{3}{5}$ mile off the beach. To the westward of these bluffs is the mouth of the Tecogame River, and the Alotengo Lagoon. The land behind the beach is heavily wooded, and in a series of foothills and ranges finally attains a height of upward of 8,000 feet. These hills and ranges begin near the beach, running off in a northeasterly direction, and in going up or down the coast inshore their sea ends, when first seen and before they are well above the horizon, have the appearance of points and islands.

Immediately to the westward of the Rio Verde the land rises rapidly to a height of 1,000 or 1,200 feet, and just off the beach in the bight to the westward of the river the water is the shoalest and the bottom most uneven.

Five miles westward of the Rio Verde are two or three rock bluffs, and 1½ miles westward of these bluffs is a reef of rocks ½ mile offshore. These rocks are two or three in number, from 10 to 15 feet high, and can be seen only when close in; the water is deep and free from danger close outside of them.

Seen from the castward or the westward, the land at the Rio Verde appears as a low sandy point covered with trees, 1 or 2 miles long, with heavy breakers off it.

Minizo Anchorage Light, group occulting white, visible 11 miles, is exhibited at a height of 43 feet from a square white tower 34 feet high at the eastern end of Alotengo Lagoon. This light has been reported unreliable.

Rio Verde, the largest river on this part of the coast, enters the sea 51 miles eastward of Maldonado. It has its source beyond Oaxaca, and like the Sacatula, after draining a large extent of country, deposits an immense amount of débris at its mouth. is supposed that the low land at its mouth is gradually extending out into the sea, and that the river causes the shoal water to the westward, as well as the holes and deep pits outside. During and after the rains the water is discolored for a long distance offshore. The mouth of the river is closed by a bar with very little water on it, on which at a distance of 3 mile from the beach the sea breaks heavilv. The breakers extend in a horseshoe shape from beach to beach. with deep water close to the outer curl. The natives state, and their statement is confirmed by the jefe politico of Tututepec, that there are several rocks directly in the line of breakers. It is impossible to enter the river with boat or canoe, and even the natives never attempt it.

Playa San Juan is the name given to the beach extending from Verde River to Galera Point, a distance of 6 miles.

Punta Galera (Little Morro) is a bold, barren, and isolated rocky bluff or headland of a grayish color, with several detached rocks off its eastern end, and connected with the mainland by a low, narrow strip of land. When first seen from the westward or the eastward it appears as an island well out from the coast line; from the westward, inshore, Morro Hermoso appears to the northward of it and over the Verde Point.

A sunken reef, with only 6 feet of water on it at low water, lies 600 yards southeast of Punta Galera; with a heavy swell the sea occasionally breaks on this reef.

Another reef of rocks, from 10 to 15 feet above water, lies 1,200 yards eastward of Punta Galera and 1 mile from the sand beach; this reef extends about 300 feet in an easterly and westerly direction, and on it the sea breaks heavily. There is deep water all around these rocks and a passage between them and Galera, but owing to the sunken reef southeastward of the point the passage can not be considered a safe one.

Chacahua Lagoon.—To the northward of the Galera is the outlet to the Chacahua Lagoon, acress which is a sand bar with a depth of 4 feet over it during the rainy season but at other times dry all the way across, the surf breaking heavily upon it. When the bar is open a boat can enter the lagoon by watching for a smooth time with no greater inconvenience than filling.

The lagoon extends from the Galera to the base of the Morro Hermoso and some distance inland; its waters are fresh but highly impregnated with sulphur, and even were its waters sweet a supply could not be obtained owing to the difficulty in crossing the bar. The lagoon has a depth of from 12 to 15 feet during the rainy season, but this depth is reduced about 4 feet during the dry season. Just behind the Galera, native sulphur in small particles crops out on the surface of the hill, and metal implements change color in a few minutes when immersed in the water of the lagoon.

Tututepec, about 10 miles 11° from the Galera, is an Indian village of 2,000 or 3,000 inhabitants, governed by a jefe politico. The village is situated on a spur of the foothills about 900 feet above the sea, and can be seen well from the offing when the sun shines upon it; the church shows as a white spot on the hillside.

Between Tututepec and the coast is an extensive plain plentifully watered by clear running streams and well adopted to the growing of sugar cane and cotton.

To the northward of Galera and Tututepec the hills are brown and barren, having a spotted appearance from the offing; elsewhere they are densely wooded.

Supplies.—Beef, fowl, eggs, fruit, etc., can be obtained by sending to the village for them.

Chacahua Bay, between Galera on the westward and Morro Hermoso on the eastward, is 6 miles wide and in the western part extends to the northward a mile within the points. The bay shore rises to a ridge which is covered with a dense undergrowth and stunted trees.

Anchorage.—There is good anchorage anywhere in the bay in from 6 to 10 fathoms, but the best is between the reef of rocks above water and the sand beach to the northward.

Morro Hermoso, a rounded bluff or headland 837 feet high, looks like an island when seen from the eastward or the westward. The southern face is quite steep, bare, of reddish color, and without any vegetation, but the inshore side, to the middle of the top, is covered with heavy undergrowth and thick timber; the line between the wooded and the barren part is well marked. The eastern end of the morro is only about 300 feet high, and very abrupt on the sea face. The southeastern point of the morro is called Punta Encomiedo.

A vessel can pass within a mile of the point, as all known rocks and dangers show themselves above water and are close to the rocky shore.

Rio Grande.—At 4 miles from Punta Encomiedo is the mouth of the Rio Grande, which, like all other rivers here, is closed with a sand bar, open only during the rainy season. The water is shoal off the mouth of the river and between it and Morro Hermoso.

Coast.—At 6½ miles eastward of Punta Encomiedo is a low flat rocky bluff, only about 30 feet high, the first break in the sand beach eastward of the morro. A sunken rock with only 9 feet of water on it lies 135° from this bluff, ½ mile from the beach. The sea occasionally breaks on the rock, but this can not be depended upon.

Piedra Blanca or Alcatraz.—At 10 miles eastward of Punta Encomiedo there is a sharp rocky black bluff about 90 feet high, and a mile farther eastward is Piedra Blanca, a small rocky islet, of whitish color, about 200 yards long in an eastward and westward direction; to the eastward of it are a couple of detached rocks showing above water. The islet is about ½ mile off the beach, with from 2 to 6 fathoms inside of it, but the passage is not safe, as a reef extends from the islet toward the sharp black bluff to the westward. Outside of Piedra Blanca the water is deep close-to.

About 6 miles eastward of Piedra Blanca is the mouth of the Manialtepec River, eastward of which are a few huts on the beach, and a mile or so inland a small village. From Piedra Blanca the coast trends in a gradual curve to the eastward for 15 miles to the bluffs on the western side of Escondido Bay.

Escondido Bluffs are perpendicular and rocky, from 50 to 100 feet high, the seaward face of a grayish color, their tops flat and covered with low bushes and trees. These bluffs are the only ones of any size from Morro Hermoso to those westward of White Rock, near Port Angeles. The extreme western bluff is a low, flat point of a decided red color. A bright yellow spot about midway in the Escondido Bluffs can be seen a long way to the westward.

Escondido Bay, between the bluffs on the westward and Escondido Point on the eastward, is open to southerly and westerly winds, but is an excellent anchorage with good holding ground. Bring the

rocks, Piedra de la Marina, in the northeastern part of the bay, tobear about 20° and anchor in 11 to 13 fathoms of water on thisbearing. Rise and fall of tide 6 feet, approximate.

The eastern part of the bay is bounded by rocky bluffs, with twoor three detached rocks lying off and close to the point. To the southward and westward the water is shoal.

Landing is good at the head of the bay.

Supplies.—Beef, fowl, eggs, fruit, etc., can be obtained here, but: no fresh water.

Cerro de la Ocote, 2,161 feet high and 4 miles 22° from the bay, together with the high bluff, is the best mark for finding the bay. The lead will guide in to the anchorage.

San Pedro de Mistepec lies about 9 miles northward of Escondido-Bay and, like Tututepec and other small inland towns, is governed by a jefe politico.

Road to Oaxaca.—An excellent road leads from Escondido Bay to the city of Oaxaca, and according to the natives is better and shorter than that from Port Angeles to the same place. The two-roads join at some miles from the coast.

Sicatela Point.—From Escondido Point the coast trends southeastward for 2 miles to Punta Sicatela, a low sandy point, covered with mangrove bushes. The water is shoal off this point, and breakers extend some distance seaward.

Sicatela River, which discharges immediately westward of thepoint, is, for Mexico, a large and important stream, but like nearly all these rivers its mouth is closed with a sand bar impassable forboats.

At 9 miles eastward of the river the sand beach is again broken by low rocks and flat bluffs extending into the sea.

Point of Rocks, about 12 miles eastward of Point Sicatela, is allow sandy point covered with mangroves, with several small detached rocks off it; the water is shoal, the bottom rocky, and heavy breakers extend some distance out from the shore. For upward of 5 miles along here there are several rocks and bluffs on the beach, with very foul bottom off them.

Coast.—Eastward, 15½ miles, from Point of Rocks is a large, bold, rocky bluff projecting a little from the general line of the coast. It is 255 feet high, and covered with brush and dense foliage, except on the sea face, which is of bare brown and yellowish rocks. Off its base are a couple of detached rocks 20 to 50 feet high. This bluff is at the extreme eastern end of the sand beach commencing at Morro Hermoso, and is the commencement of the rocky bluffs to the westward of Port Angeles.

A mile southeastward of this bluff is a low, rocky point projecting mile 157°, off which are several detached rocks. Eastward of the

end of the beach, $\frac{1}{2}$ mile, is a smooth, round hill of brown appearance, which, as seen from the westward, projects and shows as a bare point.

From the end of the sand beach to Port Angeles, a distance of 5½ miles, the coast is a continuous series of rocky bluffs, rising abruptly from the beach to a height of from 100 to 500 feet. Several small rocks lie off these bluffs, but close in, with deep water outside.

White Bock, 2½ miles westward of Port Angeles, is a round, rocky islet of whitish color, 106 feet high, nearly ½ mile in circumference, and lies about ½ mile from the beach. The outside or south edge of this rock is the extreme south point of the Mexican coast, west of the Gulf of Tehuantepec.

Black Rock, ‡ mile west of White Rock, is a small detached rock, black in color, 40 feet high, and not more than 50 feet acress.

Caution.—The coast recedes a little behind these rocks, forming a shallow bay. The bottom is very foul, in fact full of sunken rocks, and vessels should not enter the bay, nor go within a mile of the rocky bluffs to the westward of White Rock. A ship can go within 200 yards of White Rock or the bluffs to the eastward or the westward of Port Angeles, as there is deep water and all dangers show themselves above water.

Port Angeles, or Pachutla, as it is called by the natives, is the port of entry of Oaxaca, and is connected with the city of Oaxaca, the capital of the State and present railway terminus, by a very good road. The place is of very small commercial importance, and serves only as a base of supplies for the immediate neighborhood, which is very thinly populated. When the railway connecting Salina Cruz with the capital is completed, it is probable that Angeles will cease to be a port of entry. The entrance to the port is 2½ miles from White Rock, and to find the entrance strangers would do well to get near White Rock and then steam close inshore to the eastward; the distance, 2½ miles, is no sure guide, however, as the current may be strong either with or against the vessel.

The head of the bay is marked by a white sand beach about 500 feet long, which is the first sand beach seen after reaching the bluffs eastward of White Rock; to the eastward of the sand beach, and out of sight from the entrance, are three or four buildings used as storehouses. Eastward of the entrance is a bold round abrupt bluff, 300 feet high, covered with trees, with a low detached rock off it.

All the bluffs in the vicinity of Port Angeles are covered with trees and a dense undergrowth; their faces are bare, abrupt, and gray, while their bases, where the sea washes against them, are dark or almost black in appearance.

The United States is represented at Oaxaca by a consular agent.

Anchorage.—The bay is very small, with depths from 4 to 7 fathoms, but affords good shelter and an excellent anchorage for schooners and small craft during the dry season, which lasts from the end of October to the beginning of June. Large vessels can anchor within the line from the outer southwest rock to the southeast bluff, in 10 fathoms of water, bottom gravel and sand, and with 45 fathoms of chain will swing clear of the rocks on either side. At times a very heavy swell sets into the bay. During the rainy or bad season sailing vessels run great risks in frequenting this port, as the anchorage has no shelter from southerly gales, and with winds from the southward they would find difficulty in getting under way.

Port Angeles Light, flashing white, visible 20 miles, is exhibited at a height of 185 feet from a white octagonal stone tower 44 feet high, with white rectangular house, on Izuca Point, ½ mile westward from Port Angeles Anchorage. The coast is high in general and very bold. At ½ miles westward from the lighthouse and 600 yards from the shore are three detached rocks called, respectively, Black Rock, Little Black Rock, and White Rock.

Communications.—The Panama-Acapulco coast steamers of the two South American lines call about once a month each way. The Kosmos Line calls occasionally.

Supplies.—Neither water nor supplies can be obtained; there is a small spring of excellent water near the head of the bay, but the quantity of water to be got from it is insignificant; there is good shooting, and small game is very abundant.

Coast.—About 1‡ miles eastward of Port Angeles, between two large bluffs, is another sand beach about the size of the one at Port Angeles, but not so far back. On the hillside behind this beach are two buildings of reddish color; these buildings and the sand beach are good marks for Port Angeles when coming from the eastward and close in.

From Angeles the coast breaks away to the northward and eastward for nearly 4 miles, and then trends in a general easterly direction for 15 miles to the entrance of Sacrificios Harbor. There are several rocky bluffs in this stretch of coast, with strips of sand beach between. At 10 and 13 miles, respectively, from Angeles are two reefs of detached rocks, some of them above water and from 10 to 20 feet high; they extend 400 yards off the beach, but as they show themselves, and the water is deep outside of them, they can be approached, if necessary, to within a mile.

The land behind the bluffs between Port Angeles and Sacrificios Harbor is heavily wooded, but low and flat as compared with that to the eastward or the westward.

Soundings.—The deepest water on any part of the coast from Mangrove Bluff to Ventosa Point is found off Port Angeles and Sacrificios.

Currents.—Along the coast from Tartar Shoal to Ventosa Point the currents are exceedingly irregular in direction and force as well as in duration, sometimes setting to the eastward with a velocity of from $\frac{1}{2}$ to $2\frac{1}{3}$ knots, and within 12 hours running as strong in the opposite direction.

Sacrificios Harbor is very small and adapted only to small vessels. The harbor is sheltered from easterly winds by Sacrificios Island, about 1 mile in length, and surrounded by outlying rocks. The shore of the bay is also lined with rocks to a considerable distance, on which the sea breaks heavily. The soundings inside are regular, from 8 fathoms at the entrance to 4 fathoms at the head. The passage between the island and the mainland has a depth of 4 fathoms, but its use is not recommended.

Rock.—A sunken rock, having but 11 feet of water over it at low water, lies in the approach to the harbor, on the following bearings: Western extremity of Sacrificios Island, 352°, distant 600 yards; southern extremity of western entrance point 266°, distant about 800 yards. There are 7 fathoms of water close to the rock on all sides.

Tides.—High water, full and change, is at 2h. 50m.; springs rise 4 feet, approximately.

Supplies.—No water and but few supplies can be obtained at Sacrificios, which though formerly a port of entry for the city of Oaxaca, is now abandoned.

Directions.—To enter the harbor, bring the western point of Sacrificios Island to bear 19°, in range with a peaked hill 270 feet high, and stand in on this course until the southern extremity of the western entrance point bears 266°, whence a course 2° leads through in mid-channel in depths of 7½ to 5½ fathoms.

Coast.—From Sacrificios Harbor the coast trends to the northward and eastward 4½ miles to Cacaluta Island and is a succession of bold bluffs about 100 feet high, with detached rocks off but close to each bluff. The tops of the bluffs are covered with dense undergrowth and bushes. From the island the coast trends to the northward and eastward about 2¼ miles to the Bufadero, at the entrance to Port Guatulco.

Cacaluta Island is about $\frac{1}{3}$ mile in diameter, 220 feet high, and lies $\frac{1}{3}$ mile from the shore. Behind and on each side of the island is a white sand beach. When in the offing, abreast of Cacaluta, the island and the first bluff eastward of it appear as two bluff headlands, and both might easily be taken for islands.

Anchorage.—To the eastward of Cacaluta Island there is an anchorage in 7 fathoms of water and a good boat landing. Behind

the island the Tayuta River empties into the sea, and here fresh water may be had with little trouble.

Bufadero Point, half a mile southwestward of port Guatulco, is a good mark for distinguishing the harbor. In one of the rocks close inshore and level with the water, there is a cave, called the Bufadero, with a small aperture in the roof, and every swell that enters the cave forces the water violently through the hole, resembling the spouting of a large whale. At night or in foggy weather, when it is calm or the wind is from the shore, the sound, like the blowing of a whale, can be heard at some distance.

Port Guatulco is separated from Santa Cruz bay by a small peninsula 150 feet high, jutting out from the mainland 800 yards. The inner harbor of Guatulco, being landlocked, is the best, for small vessels, from Acapulco to Ventosa; the other anchorages are open to the southwesterly winds, which often blow on this coast. There is good clear ground in all parts, and the soundings are gradual, from 20 fathoms off the entrance to 5 and 3 fathoms very near the beach. The bay is bounded by a smooth shore very good for landing, and there is a small fresh-water brook running into the sea during the rainy season.

Santa Cruz Bay is much larger and more open than Port Guatulco, and an anchorage can be had in any portion of it in 5 to 10 fathoms, with shelter from all winds except those from the southward and eastward. As both bays are open, no directions are needed other than to keep off the visible rocks and anchor with room to swing.

No supplies can be had in either of these two bays except fresh water and fresh beef in small quantities. Rise and fall of tide 6 feet, approximately.

Directions.—As both Santa Cruz Bay and Port Guatulco are open, no other directions are needed than to keep off the visible rocks, and to anchor so as to have room to swing.

Piedra Blanca.—To the southward and eastward 800 yards from the peninsula that separates the two bays is a reef 400 yards long in an east and west direction. The westernmost rock, which is 90 feet high and about 500 yards in circumference, is called Piedra Blanca of Guatulco, and is composed of 8 or 10 separate rocks, the smallest of which is barely above water. There is a passage between this reef and the peninsula, but it is considered unsafe, as another reef extends some distance from the peninsula in the direction of Piedra Blanca.

Landmarks.—When in the offing, perhaps the best mark for the the harbors of Guatulco and Santa Cruz is the Cerro de Zadan, a bell-shaped mountain, 5,677 feet high, 13½ miles due north of Piedra Blanca. The mountain is of reddish-brown color, owing to the absence of any brush or undergrowth, though possibly green during the rainy season, and on its northern side a ridge connects it with

the higher range of the Cordilleras. When near the coast the best marks are the Bufadero and Piedra Blanca. These harbors are so difficult to distinguish that vessels are said to have been more than a fortnight in finding them.

When about 5 miles offshore from the Bufadero, the extreme western point of land has a rocky, broken appearance, and is not so high as the land adjoining. When 6 miles out another cape farther westward can be seen; its extreme point is rather low, but rises gradually inland to an elevation of 1,200 feet; this low point is the land of Port Angeles.

Cerro de Leon, 10 miles 310° from Zadan, is 10,300 feet high, the highest peak along this part of the coast. The land back is covered with stunted trees and brushwood, but over the foothills a few miles from the coast the land is well cultivated.

Tangola Tangola Bay, which is separated from Santa Cruz Bay a square-shaped peninsula about 1,600 yards wide at the outer end, has a width of 1,200 yards at the entrance between Tangola Tangola Island and the western entrance point. The bay contains several small rocky islets, which can be approached close-to, and there is no danger in entering the bay, where there is anchorage, with good holding ground, in from 5 to 10 fathoms, bottom of sand and shell. Off the western entrance point there is a reef of rocks, but the water is deep close to the outer rock, which is awash. There is usually a very heavy swell setting in from the southward.

Supplies.—Fresh water can be had with little trouble, as there is an excellent spring and stream at the head of the bay, but no provisions can be obtained. There is said to be good shooting in the vicinity, and pearl cysters and abalones are abundant.

Tangola Tangola Island is separated from the mainland by a passage 200 yards wide, with 3 fathoms of water in it. This passage is considered unsafe, as the channel is very narrow in several places. The island is remarkable in appearance, and easily recognized; it is about 800 yards long, northeast-southwest, 600 yards wide, about 200 feet high, and its top is covered with heavy undergrowth and bushes. From the westward the island makes as part of the mainland; the outer part is a cliff of brownish stone.

Sunken rock.—Off the second bluff to the eastward of Tangola Tangola Island there is a sunken rock; it lies southeastward of the bluff and within 100 yards of the beach.

Capulita River, which discharges into the sea 3 miles northeastward of Tangola Tangola, is a small stream with a bar across its mouth, which is impassable.

Coast.—From Tangola Tangola the coast trends in a northeast direction for 20 miles to the Morro Ayuca, the southern entrance

point of an open bay, lying in latitude 15° 52′ 17″ N. and longitude 95° 46′ 43″ W.

There are over 20 headlands in this stretch, from 100 to 200 feet high, projecting but little beyond the general line of the coast. Most of them have a steep cliff facing the sea, with fine sandy beaches between them. The land behind rises in irregular-shaped hills toward the Cordilleras, which are three or four ranges or foothills, then to the high back range, 10,000 feet high.

Anchorage may be had abreast the beaches in from 8 to 10 fathems of water, sandy bottom, about 1 mile from shore.

Morro Ayuca is a bold cliff, 270 feet high, surrounded by a reef with deep water close-to. The reef extends around the morro to the northward, losing itself in the sand beach of the bay.

Behind and near the morro is a large lagoon into which empties the small river of Ayuca, the stream that runs by Haumilulu. During the rainy season the lagoon breaks through the beach just to the westward of the morro.

Morro Ayuca Light, group flashing white, visible 17 miles, is exhibited at a height of 147 feet from a square white concrete tower, 54 feet high, with keeper's house at the base.

Ayuca Bay is open to all winds from the eastward and the southward, yet is a safe anchorage at all seasons. Vessels can anchor anywhere in it, with due regard to the draft of the vessel and the locality of Ranger Rock. The best anchorage, however, is in the western part of the bay, in 7 fathoms of water.

Ranger Rock, with 1½ fathoms over it, lies with Ayuca Point bearing 230°, distant about 1.6 miles, and the hill (120) just northward of the lagoon bearing 319°.

Estrete Island, 12 miles from Ayuca Point, is a barren rocky white islet, composed of two rocks of about equal size and two or three outlying reefs. There is a passage between the island and the mainland, with deep water all around and close to the rocks.

Coast.—Between Morro Ayuca and Chipequa Point, a distance of 25 miles, are several bluff headlands with fine sand beaches between them. These bluffs, which are gray and almost perpendicular to the water's edge, project but little from the general coast line and afford no shelter.

Behind the beach the hills are barren and brown in the dry season, but during the rainy season their appearance is more pleasing. About 21 miles from Ayuca Point and 9 miles from Estrete Island there is a remarkable dome-shaped bluff, covered with a dense undergrowth of stunted trees and bushes. At the base of this bluff, close to the beach, are two detached rocks, cone-shaped, and from 20 to 30 feet high.

Rock awash.—At 500 to 1,000 yards from this dome bluff is a rock awash. At high water the sea seldom breaks on it, and it can not be seen, but at low tide the sea breaks at each swell and the rock is visible. Seven to 12 fathoms are found close up to the rock.

The currents here are very irregular and at times very strong.

Bamba Bay.—From the dome bluff, just mentioned, to Chipequa Point, the shore recedes to the northward and forms the bay of Bamba. This bay should not be entered unless actually necessary, as there are two sunken rocks in the western part, 1,000 to 1,500 yards from the sand beach.

Chipequa Point is a very remarkable headland, being one immense and growing sand down. It projects nearly a mile from the line of the coast and forms a kind of double headland. From the westward, it shows as a bold dark cliff, surmounted by a belt of sand over its top or back, and is an excellent landmark. The outer end is rounding and brown, the rest a remarkable sand down, both sides being covered with sand from the top to the beach, the whole quite bare of vegetation except a few stunted bushes on the eastern slope, which crop out through the sand. This is the first sand down seen from the westward; but there are two or three smaller ones between it and Ventosa.

Just behind Chipequa Point is a very remarkable knifelike ridge, mile long in a northwest by west and southeast by east direction and from 1,000 to 1,500 feet high, sloping gradually to the westward, but almost perpendicular on the eastward side, one-third of the way down from the top. This ridge terminates in a reef north-eastward of Chipequa Point and 1,500 yards from the nearest beach, consisting of four or five detached rocks from 10 to 15 feet high and covering an area 125 feet in diameter. Shoul water extends westward from the rocks about 600 yards and between the shoul and the shore there is a narrow channel with about 4 fathoms of water, but unsafe for use; outside and close to the rocks the water is deep.

It may be mentioned here that detached rocks and rocky reefs extend off all the points from Sacrificios to Ventosa, and it is not prudent to go within 1,000 yards of any of them.

Chipequa Bay, between Chipequa and Guela-gichi Points, is about 5 miles wide and from 1 to 2 miles deep. There are clean even soundings on a sandy bottom, from 2 fathoms close in to the beach to 20 fathoms at the outer limit of the bay. The beach is clean, hard, white sand, and behind it is a level plain, heavily timbered, extending to the foothills. Near the beach is a lagoon and a well of fresh water.

Although Chipequa Bay is open to all winds from the northeastward to the southward, it is considered in all seasons the best anchorage from Acapulco to La Union. It is far more commodious and better protected, has a better boat landing, less surf, and is in every way superior to either Ventosa or Salina Cruz. At the full and change of the moon a heavy swell always sets in and increases the surf on the beach; but boats can be landed at all times.

Anchorage.—There is good holding ground in all parts of the bay, but the best anchorage is in the western part, between the reef of rocks and the sand beach to the northward. No supplies of any kind can be obtained here, but there is excellent shooting.

Guela-gichi Point is a bold bluff, 535 feet high, nearly 500 yards wide, and covered with stunted pine trees.

Coast.—Between Chipequa and Ventosa Points there are four bays, all affording anchorage, viz, Chipequa, Conejo, Salina Marques, and Salina Cruz. While off each bluff are detached rocks showing above water, the whole of this coast can be approached within a mile in safety; between the bluffs are stretches of sand beach on which the surf breaks heavily. On Conejo and Salina Marques Bluffs are sand downs less extensive than that on Chipequa Point.

Conejo Bay, between Conejo Bluff and Morro de Salina Marques, is a small indentation of the coast about 2 miles wide and open to easterly and southerly winds. The soundings are regular all over the bay and the holding ground good, but on account of the heavy surf rolling in on the steep beach there is no boat landing.

Hermosa Cone, a solitary conical peak, 300 feet high, stands north of the bay, at 500 yards from the beach.

Salina Marques Bay, between Morro de Salina Marques and Morro de Salinas, is a little larger than Conejo and lies in the same general direction; the soundings are regular on a hard sand bottom; there is no boat landing. Behind the sand beach there is a large lagoon which discharges into the sea during the rainy season. This bay and Conejo Bay are used but little, owing to the close proximity of the bays of Chipequa and Salina Cruz.

Morro de Salinas is a round rocky projection from which several clusters of rocks above and under water extend 250 yards; just outside of them the water is deep. The morro is 241 feet high, with an almost perpendicular cliff to the eastward.

Morro de Salinas Light, flashing white, visible 23 miles, is exhibited at an elevation of 272 feet above the sea, from a white cylindrical tower, 50 feet high, with white rectangular house at the base, situated on the Morro de Salina Cruz, near the port which is under construction. The Cerros de Morros, 4 miles to the eastward, cause an obscure sector in the light, See Light List.

Sunken rock.—There is a sunken rock to the southward and westward of the morro and about 200 or 300 yards offshore. It is on a line with Morro de Salina Marques and the outer rock.

Salina Cruz Bay, formed by a slight indentation of the coast between Ventosa Point and the Morro de Salinas, is exposed to all southerly winds, which are always light, and to a heavy swell from the southeastward, which is general from May to October. The northers also blow with great fury from November to March, two or more anchors being necessary on such occasions.

Salina Cruz is the port of entry for the Isthmus of Tehuantepec. Extensive port works are now approaching completion. The port comprises an outer harbor protected by two breakwaters, one extending from the Morro de Salinas, for a distance of 630 yards; the other extends for 1,100 yards in a southwesterly direction from the shore, commencing about halfway between Morro de Salinas and Ventosa Peak. The outer harbor has an area of 138 acres, with an entrance 656 feet wide, and an inner basin has an area of 69 acres, having a depth of 33 feet at low water. The inner basin is entered through a passage 100 feet wide, and can accommodate vessels of 24 feet draft; the depth is to be increased to 33 feet. The wharves, on which there are six large warehouses, are equipped with electric capstans for docking ships, and a number of electric cranes for handling cargo.

Note.—Dredging has been infinitely suspended and the channel has silted up.

At Salina Cruz the United States is represented by a vice and deputy consul.

A concrete dry dock is available; its dimensions are 607 feet long, 100 feet wide, with 39 feet of water on the sill at high tide.

The old town has been entirely destroyed and rebuilt on a new site, with a complete modern system of drainage and water supply. The natives, have, however, reerected their huts to the westward of Salina Cruz.

The place is very healthy during the dry season, but during the rainy season, from May to September, yellow fever is prevalent. The place is of importance as being the southern terminus of the railroad to Tehuantepec; that railway is completed across the isthmus to Coatzacoalcos, and should the line from Puebla to Oaxaca be continued to Tehuantepec the port will rise in importance.

A powerful steam tug is available. The most prominent building is the harbor works office, a three-story structure, 100 feet long, situated opposite the harbor entrance. On an eminence on the eastern side of the town is the new cable station, white, with red roof.

Breakwater lights.—From a red metal pillar, erected at the head of the eastern breakwater, is exhibited a fixed white (unwatched) light, elevated 42 feet, and visible 11 miles.

From a white metal pillar, erected at the head of the western breakwater, is exhibited a fixed red (unwatched) light, elevated 42 feet, and visible 9 miles.

Anchorage may be had either outside or inside the breakwaters. The depth of water inside the breakwaters are 8 to 10 fathoms in the outer part, with 6 to 8 fathoms nearer the shore, bottom sandy mud, good holding ground.

The western portion of the harbor is obstructed by a bank extending from the shore, having depths of $3\frac{1}{2}$ and $4\frac{1}{2}$ fathoms, and the depth over the anchorage space is reported to be decreasing; the bottom is of mud.

Buoys.—Two mooring buoys have been established in the eastern part of the outer harbor and a warping buoy at the entrance to the inner harbor.

Pilotage is not compulsory. A pilot meets vessels in the daytime, up to $1\frac{1}{2}$ miles outside the breakwater, in a pulling boat, which carries a small flag. No pilot goes out at night.

Quarantine.—Ships with infectious disease on board must anchor in the roadstead.

Supplies.—Provisions, poultry, and meat are plentiful, but vegetables are scarce. There is no bunker coal obtainable.

Tides.—High water takes place at 2h. 50m., at full and change. Mean rise 5.5 feet.

Water.—Water obtained from the shore should not be used for drinking purposes.

Communications.—There is daily communication by passenger train with Mexico City, Vera Cruz, and Coatzacoalcos, and this port is the Pacific terminus of the Tehuantepec National Railway (Mexican Isthmus route), which gives through communication with the Republic of Guatemala. The Pacific Mail steamers call on their way to and from Acapulco to land and take passengers. The Kosmos Line steamers call regularly for passengers and freight. A line of coasting steamers connects all the coast ports and has regular sailings for Honolulu, Japan, and Hongkong. Two lines of telegraph meet here, namely, that of the Federal telegraph system, which passes through the city of Oaxaca and gives overland communication with the United States, and that of the Mexican Cable Co., which crosses the isthmus at this point. Two cables are laid from here, one to San Jose and La Libertad, the other to Panama, giving communication with all parts of the world.

Weather signals.—Weather signals are displayed from a flagstaff on a conspicuous gray building situated on a hill northward of the harbor.

Directions.—The position of Salina Cruz is now clearly indicated by the white lighthouse on Morro de Salinas. Six salient points, Chipequa, Guela-gichi, Conejo, Salina Marques, Morro de Salinas, and Morro de Ventosa, project from the coast; a vessel can without danger coast these at a distance of 4 to 5 miles; on rounding Morro de

Salinas, the harbor works, the houses on the beach, and the custom-house will be seen, and to the east the telegraph house; two telegraph cables from the eastward being landed here.

Vessels should be careful not to anchor near the submarine telegraph cables, as shown on the chart.

Sailing vessels bound to Salina Cruz from the southward or southeastward are recommended to make the land to windward of the port.

During strong north winds sailing ships can not enter the outer harbor, but must anchor outside and wait for a tug.

Landmarks.—The best landmarks for approaching Salina Cruz are the Shadani and Tecuani Mountains. Shadani, $3\frac{1}{2}$ miles northwestward from the bay, rises to a peak, 1,070 feet high, with a remarkable square flat rock on the summit, 60 feet high and 150 feet square, resembling a house. Tecuani, $1\frac{3}{4}$ miles westward of Shadani and 5 miles from the bay, is a remarkable whalebacked mountain, 2,214 feet high.

The lighthouse on Morro de Salinas now serves to distinguish it from the other five exactly similar points that project from this part of the coast.

Tehuantepec City, with about 1,400 inhabitants, is situated on the Tehuantepec River, about 10 miles from the mouth, and lies northward 9 miles from Salina Cruz, with which it is connected both by the railway and by a good wagon road, the distance by the latter being 15 miles. The city is in telegraphic communication with the world. Poultry, fruit, and vegetables can be procured here in small quantities.

Ventosa Point, 2½ miles eastward of Morro de Salinas, is a bold rocky headland jutting out from the mainland. Off the point are many outlying rocks from 50 to 150 feet high, with deep water close-to. The point can not be mistaken, as it is the last of the high land on the western part of the Gulf of Tehuantepec.

Ventosa Bay, to the northward and eastward of the point, is about 2 miles wide, and but little over ½ mile deep. The soundings in the western part are irregular, and on account of the great amount of sediment brought down by the Tehuantepec River during the rainy season this part of the bay is fast filling up. This fact and the great difficulty in making a landing here even in the best of weather, together with the known superiority of Salina Cruz, caused the transfer of the customhouse to that place.

Tehuantepec River discharges into Ventosa Bay about a mile northward of the point. The bar across its mouth dries at low water in the dry season; canoes cross at high water, but heavy breakers extend a mile outside the bar, their outer limit increasing in distance

from the beach in proportion as this part of the bay fills with the deposit from the river.

Coast—Gulf of Tehuantepec.—Eastward of Ventosa Point the coast sweeps around in a gradual curve of large radius forming the great Gulf of Tehuantepec. As we have seen, westward of Ventosa, to and beyond the turn of the coast at Port Angeles, the shore is of a bluff and rocky character, with intermediate sand beaches and deep water close up to the bold bluffs, while the mountains are rugged and stand not far back from the shore. At Ventosa this character changes, and the shore is a whitish-gray sand beach which extends away to the eastward some hundreds of miles, unbroken by a single rock, with a gently shelving bottom and moderate depths far from the The mountains to the eastward somewhat resemble tablelands and sweep away inland to a maximum distance of about 25 miles, leaving a large low area, partly occupied by an extensive lagoon and its numerous branches or divisions, with a few scattering hills or mounds, ranging from 236 to 2,280 feet in height, the highest standing farthest to the eastward. This low area is sparsely wooded, and parts of it are under cultivation, while large numbers of cattle graze in the open country.

The mountain chain forming the backbone of the continent, here confined to the narrow limits of the isthmus, becomes lower, affording in one place a pass through which a survey for an interoceanic ship canal has been made. The Tehuantepec Railway and a telegraph line cross the isthmus here from Salina Cruz to Coatzacoalcos, the latter connecting the telegraph cables on either side that form a part of the North and South American telegraph system.

After this low plane is passed, the mountains gradually begin to rise and spread out, approaching the coast line again, until at Soconusco Bluffs a detached cluster of hills very near the beach forms a prominent landmark. Farther to the eastward the mountain chain extends nearly parallel with the shore line, and between it and the shore there lies a low wooded belt, filled with many lagoons.

The entire coast line from Ventosa Point to Acajutla is a sand beach with not a single outlying danger; behind the beach a lagoon extends nearly the entire distance, fed by numerous small streams and rivers.

Anchorage may be had in from 10 to 15 fathoms of water, sandy bottom, almost anywhere along this stretch of beach. There is no protection against winds from any southerly direction, but the northers blow offshore, and vessels can readily put to sea.

Landing.—A heavy surf is almost constantly breaking on this beach, and landing is an extremely hazardous undertaking; at times, however, the surf subsides, and a landing may be made at any point.

Winds.—Besides the variable winds, which are rather light, and the land and sea breezes of the morning and evening, two prevailing winds, the north-northeasterly and south-southwesterly, blow during a great portion of the year on the southern coast of the isthmus. The first of these is not felt to the eastward beyond the Tonala Boca, nor to the westward beyond the mountains of Chahuhe, the western boundary of the lagoon of Tongulunda.

The north-northeasterly wind, which usually begins about the 15th of October and ceases in the first part of April, blows in November almost without interruption, and at that time reaches its maximum; toward the middle of December it ceases during intervals of from 10 to 12 days, and then, beginning anew, blows 1 or 2 weeks. These alterations or interruptions are reproduced at short and unequal periods, but the length of the period or discontinuance goes on gradually increasing until the wind blows for only one day, and finally ceases completely.

During this season the violent northers of the Gulf of Mexico frequently cross the isthmus through the opening between the Mexican and Guatemalan mountains, and blow in sharp squalls on the southern side. These heavy blasts, which have the local name of Tehuantepecers, blow with great violence from north to north-northeast, raising a very short high sea, and are felt several hundred miles off the coast. They begin at northeast or north-northeastward, veer to the northward, and, in the gulf, to the northwestward, and finally die out at west as the coast of Guatemala is approached. They are not indicated by the barometer.

If when off the Gulf of Tehuantepec, northward bound, one of these gales should be met and sail can be carried, it is advisable to ease off the sheets and run well to the westward without seeking to make northing; otherwise, if obliged to heave to, from two to four days of heavy weather may be expected, with a high short sea, a clear sky overhead, and a dense red haze near the horizon. It is said by the Indians of Santa Maria del Mar that if the summits of the mountains of Chimalapa are hidden about sunset by a slate-colored vapor a norther will blow the following day; and if these mists are seen at sunset on the ocean horizon a south-southwesterly wind will blow the next day.

The south-southwesterly wind, which in winter succeeds the northerly wind during the one or two days of its cessation, is the prevailing wind during the months of June, July, and August. After some gales of more or less intensity, comparable in violence with that of the northerly wind and not exceeding two hours in duration, the southerly wind sets in definitely; still it is subject to more interruption than the northerly wind, and the intervals of calm are longer. After passing over the ocean this wind reaches the coast of the

isthmus laden with vapors which, at certain hours of the day, resolve themselves into abundant showers. During this season, which is the rainy season, the weather along the whole coast of Mexico is very bad; gales and strong breezes from southeastward to southwestward constantly occur, while squalls, accompanied by thunder and lightning, with heavy and almost incessant rain, characterize the season throughout. These gales are at times quite disagreeable, rendering the navigation of this coast very unpleasant, as with one exception there is scarcely any shelter from them to be found.

Currents.—The currents are very difficult of definition. The navigation of sailing vessels is often very difficult and tedious, owing to the embarrassment of calms and varying drifts, but there is no doubt that the currents fluctuate with the shifting monsoons which here prevail. Cape Corrientes, which is subject to the varying streams that give it the name, is probably the northern limit of these shifting streams, and between that point and Cocos Island, around which the streams are very devious, it may be considered that the general set will be to the southward between southeast and east-southeast in the winter months, and northward, between northwest and west-northwest the rest of the year; but, as before stated, nothing very definite can be laid down. The stream appears to have a breadth of nearly 360 miles, and there is a countercurrent close inshore.

Current along shore in Tehuantepec Gulf.—The currents are especially under the influence of the winds in the Gulf of Tehuantepec during the season of northers. When a norther is blowing the current sets strong to the northward and eastward along the shore on the western side of the gulf, and to the northward and westward inshore on the east side of the gulf; at other times the current sets in the opposite direction, and it is accounted for in this way: The fury of the norther blows the water out of the gulf to the southward and as the waters lower at the head, there is a rush along each shore to the northward, to supply or fill the vacancy. When the norther moderates or ceases to blow, the water that was banked up, as it were, flows back up the gulf, and the extra amount rushes out along each shore, to the southward. As this fact has been observed as far west as Rio Verde, and down the eastern coast as far as Champerico. vessels should note carefully the currents in coasting the gulf from either direction.

Off Sacrificios the current has been found as high as 2 miles per hour, setting to the northward and eastward, during a heavy norther, and 0.6 mile per hour, setting to the southward and westward, when the wind was from the opposite direction.

The strongest current, 2.3 miles per hour, was off the rock awash, 3 miles west of Chipequa Point.

Along the coast from Manzanillo to Sacrificios Point the current is supposed to set to the southeastward and eastward during the winter months, and to the northwestward and westward in summer, when the southeasterly winds prevail. This, however, is by no means always the case.

In the Gulf of Tehuantepec, on a line between Acapulco and Montuosa Island, coast of Colombia, the current generally sets to the west-northwestward, but running over to the coast of Guatemala the current will probably be to the southeastward and eastward as you approach the coast.

Crossing the Gulf of Tehuantepec.—To keep close along the shore of Tehuantepec, in running down the coast during the season of the northers, is not considered the best plan. It is better, after passing Sacrificios Point, to steer directly across the gulf, say 82°; then, in case of a norther setting in, keep the ship off and run with the wind and sea one or two points abaft the beam; the wind will veer to the northward and westward, enabling the ship to come up gradually to the course, and as the coast of Guatemala is approached it will veer and more and more to the westward until it dies out. Should it be blowing a norther at the time of passing Sacrificios Point, go up at least as far as Estrete Island, keeping 1 or 2 miles offshore.

When northward bound in a steamer, hug the Guatemala coast and follow close around the gulf shore; the wind then is constantly hauling ahead, and although it will be frequently found that after passing Soconusco Bluff in a norther the wind will temporarily die out, it will be pretty sure to freshen up again, and it is better to continue to hug the coast, giving Tonala Bar a wide berth. From Champerico to Acapulco the coast should also be hugged to avoid the strong current, sometimes over 2 knots, setting to the eastward.

Coast.—From Ventosa Point the beach trends east-northeastward for 23 miles to San Francisco Bar or Boca Barra. At 9\frac{3}{4} miles from Ventosa is a high-water break or closed mouth of a lagoon, and \frac{3}{4} mile farther a second break, both connecting with the same lagoon.

San Mateo is midway between these breaks and about 3 mile back from the beach. The whitewashed or painted dome of the church can be seen at some distance seaward, and forms an excellent landmark when the mountains are obscured. The country in this vicinity is low and sparsely wooded and cut up by branches of a lagoon extending inland.

There are two other high-water breaks, distant 13 and 20½ miles, respectively, from Ventosa.

Santa Maria, 17½ miles from Ventosa Point, stands about 1,500 yards back from the beach. Here also is a whitewashed cathedral tower standing up from a group of scattered palmetto trees, and

forming a good mark. This tower is an open cupola, while that at San Mateo is a dome.

San Francisco Bar or Boca Barra is formed at the open mouth of an immense lagoon that here connects with the sea through an opening 600 yards wide. The mouth may be readily found, as a white sand bank about 20 feet high stands about ½ mile westward of the opening, on a low spit of sand.

The growth of trees and bushes ends at some distance on either side of the opening, so that from a few miles at sea the mouth seems broad and spacious. Heavy breakers extend out from $\frac{1}{4}$ to $\frac{1}{2}$ mile at the middle of the mouth, and ordinarily there is not even a channel for boats. The lagoon extends to a distance of 13 miles away from the beach and is broad and open. It is fed by small rivers and streams, and there are several small villages on its shores. There is not over 21 feet of water in any part of the lagoon.

The village of San Francisco stands about 3 miles northeastward of the mouth of the lagoon.

Coast.—From San Francisco Bar to Tonala Bar, a distance of 47 miles, the shore line sweeps around in a gentle curve and is an unbroken sand beach, upon which a heavy surf is almost constantly breaking, rendering landing extremely difficult. Occasionally the surf is light and a landing can be made at any point. Between these two bars the country is low and wooded. A lagoon extends parallel with the coast at a short distance behind the beach.

Tonala Bar, in its narrowest place, is about $\frac{1}{8}$ mile wide, and on the eastern side a growth of trees seems to come down close to the water's edge. There is a channel, with about 12 feet of water at spring tides, and while vessels of light draft may cross at certain stages of tide and sea, it is unsafe for a small boat to attempt to enter the lagoon at this point. The bar is continually shifting. The breakers on the bar extend out from $\frac{1}{2}$ to $\frac{3}{4}$ mile from the beach and their outline is rounding, and the surf breaks across the full length of the bar. At 4 miles to the westward of the bar stand two or three huts on the dividing neck of land.

Anchorage can be had $\frac{1}{2}$ mile outside the middle of the breakers, in 11 fathoms of water.

Landing.—The nearest and best boat landing is on the beach, on the eastern side of the mouth, clear of the breakers.

La Puerta (Port Arista), 8 miles eastward of Tonala Bar, is the place of embarkation and port of entry for the town of Tonala, with about 10,000 inhabitants, which lies about 9 miles to the northeastward. About three or four houses with red-tiled roofs are visible on the beach. In approaching from the westward the lighthouse is the best mark. There are no facilities for landing freight.

La Puerta is no longer used as a shipping point and no steamers stop here. All the shipping at Tonala is now done by the Panama American Railroad. There is a dangerous surf all along the coast, the beach being steep, with one line of breakers, through which it is dangerous to attempt a landing.

During the bad season (June to October, inclusive) heavy squalls, accompanied by thunder and lightning of the severest character, occur at frequent intervals, generally coming from the southwestward; but a ship with good ground tackle would not drag, if riding to an ample scope of cable, say 75 to 90 fathoms; the squalls last but a few hours. The early part of the day is usually calm, and the coast current causes a ship to lie broadsile to the swell.

La Puerta Light, group occulting white, visible 11 miles, is exhibited from a white wooden tower, with a white keeper's dwelling northwestward of it, elevated 36 feet above high water.

The anchorage is directly off the houses, in 10 fathoms of water. The customhouse officers are provided with a set of international signal flags, and understand their use.

Communications.—The Panama-Acapulco steamers of the two South American lines call about once a month each way.

There is a fair wagon road connecting La Puerta with Tonala, a distance of 14 miles.

Landmarks.—A good mark for finding La Puerta in all weathers is Tonala Bar; in clear weather the high peak of Tres Picos is an excellent landmark. Coming from the southward, Soconusco Bluffs is also a good mark, as it is the only high land coming down to the beach.

Coast.—From Tonala Bar to Soconusco Bluffs the coast line trends away in a general southeast by east direction, with a slight curvature, for a distance of 19 miles.

Tres Picos, 7,945 feet high, rises about 19 miles from the coast, and from a distance appears as a cone, towering above the surrounding mountains. From Tonala Bar it is seen divided into three points, the middle one being the sharpest and highest, and the other two about alike in shape and size. The mountain is easily seen in clear weather from Ventosa, a distance of 90 miles.

San Marcos Bar is 4 miles eastward of La Puerta, at the mouth of a narrow lagoon. The breakers on the bar extend out a little more than 4 mile from the beach and are not very heavy. Sharks are numerous and may be seen swimming in the edge of the breakers here and at all the bars along this coast.

Soconusco Bluffs, 6 miles eastward of San Marcos Bar, are a group of hills or mounds upward of 2,000 feet high; the name "bluffs" seems a misnomer.

San Bernardo Mountains, rising 5 miles from the coast, are wooded and green in the rainy season, and light brown in the dry season; standing so near the shore they seem to abut upon it, forming the best landmark in all seasons for this part of the coast. It is at this point that the high mountain range approaches nearest to the coast, and there are peaks ranging from 6,000 to 7,000 feet in height standing less than 15 miles from the shore.

Coast.—From Soconusco Bluffs to Sacapulco Bar the coast trends in a general southeast by east direction for 17 miles. Beyond the bluffs a belt of low wooded country lies between the shore and the mountains, with occasional mounds or hills rising from it. One of these, about 1,100 feet high and with a long ridge top, stands 5 miles from the shore at a point 12 miles eastward of Soconusco Bluffs.

Sacapulco Bar is at the opening of a narrow lagoon which seems to extend all along behind the beach both westward and eastward. The opening is about $\frac{1}{8}$ mile wide and the breakers extend off it about $\frac{1}{4}$ mile; there is not enough water on the bar for ships' boats.

Coast.—From Sacapulco Bar to Soconusco Bar the beach trends southeastward for 43 miles. A lagoon extends along behind the beach for the whole distance. Thick woods come down to the edge of the sand, and palmettoes are scattered along among the other trees. At 12½ miles eastward of Sacapulco Bar is a small village, and 14 miles farther eastward is a second village.

Soconusco Bar is similar to that of Sacapulco. The opening to the narrow lagoon is about 400 yards wide, with breakers extending off ‡ mile, rendering an entrance by boat almost impossible. No habitations are visible here.

Tacana Volcano, 14,000 feet high, in sight from this bar, is on the boundary line between Mexico and Guatemala.

San Simon Bar lies southeastward, distant 19½ miles, from Soconusco Bar. The opening at the bar is about ½ mile wide, and breakers extend off ½ mile. There are 9 fathoms of water 2¼ miles off the beach at this bar.

Puerta de San Benito is 19½ miles southeastward of San Simon Bar; between them the forest borders the beach and is sprinkled with palmetto trees. The town consists of a group of about 30 thatched houses standing upon and just behind the beach. The Pacific Mail Building and the customhouse, with flagstaffs in front of them, are the largest buildings, and stand near the water. The anchorage is in 6 fathous about 1½ miles from shore. A stern anchor is necessary for the discharge of cargo.

Lighters afford the only means of landing, and are hauled through the surf by a line attached to a buoy moored outside. An iron pier is proposed. The sanitary condition of the town is poor, the climate being warm and unhealthful. Puerta de San Benito Light, group flashing white, visible 14 miles, is exhibited at an elevation of 74 feet above the sea from a cylindrical iron tower, painted white, with keeper's dwelling at base, southern side. This light has been reported irregular.

Communications.—The Panama-Acapulco steamers of the two South American lines call about once a month each way. There is telegraphic communication with the interior.

Supplies.—Provisions of any kind are very scarce. Water has to be brought from a distance of 6 or 8 miles and has a strong alkaline taste.

Tapachula, with about 15,000 inhabitants, is situated in the midst of a rich country abounding in coffee plantations, about 15½ miles inland from San Benito, which is its port as well as the port for the agricultural and stock-raising country adjacent; transportation is by ox teams, and the roads during the rainy season are very bad; the monthly steamers seem to do all the carrying trade. It is proposed to connect Tapachula and San Benito by a railroad.

Coast.—From San Benito the coast line trends southeastward 19 miles to the mouth of the Ocos River.

At $5\frac{1}{2}$ miles from San Benito a lagoon comes close to the beach, separated from the sea by only a narrow strip of land. The lagoon has doubtless had an opening here, and the bar is called Cuayacan Bar. At 3 miles from Cuayacan Bar is a similar narrow place between sea and lagoon called Suchiate Bar, and at 7 miles from the latter, $3\frac{1}{2}$ miles westward of Ocos River, is another narrow place called Ayutla Bar. All of these closed lagoon mouths are doubtless open during the rainy season.

Suchiate River, which discharges into the lagoon, 9 miles southeastward of San Benito, forms part of the boundary line between Mexico and Guatemala.

CHAPTER IX.

THE COASTS OF GUATEMALA AND SALVADOR.

Guatemala extends from the borders of Mexico to the Rio La Paz. Guatemala City, or Guatemala la Nueva, the capital of the Republic. population in 1905, 97,000, is situated on a broad table-land, 4,855 feet in height, and is connected with its port, San Jose, by a railroad. The famous volcanoes Aua, Acatenango, Fuego, and Atitlan are here seen in all their grandeur and are a distinguishing feature of this isthmus. The pricipal towns are connected by telegraph.

Climate.—The climate of Guatemala varies greatly with the varying elevations, ranging from the tropical heat of the coast lands and lower valleys, through the intermediate springlike temperature of the interior plateaus and higher valleys, to the cold and sometimes almost wintry climate of the most elevated table-lands and mountains. At Guatemala City the climate is one of perpetual spring, the temperature averaging 65° F.

Seasons.—The year is divided into the dry and the wet season, the latter commencing about the middle of May and continuing until the middle or end of October, when the dry season sets in and lasts the remainder of the year.

Ocos.—The village of Ocos, with a population of 300, situated on the western side of the entrance of the river of that name, is a port of entry. There are 20 or more houses visible on the beach, and an iron pier 1,200 feet long, seriously damaged in three places by an earthquake and completely surrounded by dry land, is visible for 4 miles. The United States is represented by a consular agent.

Ocos Light, fixed white, visible 4 miles, is shown on the railway agency, a two-story building directly behind the ruins of the pier, when steamers are expected. Communication can be had with the factor of the agency by international code.

Landing.—Two miles northwest of the village is a long red building. This is the railroad company's warehouse. About 200 yards beyond the surf, which is always heavy, and in line with this red building, the railroad company has established a large buoy. By means of a donkey engine a surfboat, capable of landing about 15 tons, is hauled through the surf to the buoy. This is the only possible way of landing. Ships with cargo usually anchor close to the buoy in about 5 fathoms during daylight and haul off 1 or 2 miles at night.

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Landmarks.—The volcanoes Agua and Fuego are excellent landmarks for this part of the coast and for making San Jose de Guatemala. Agua rises in a perfect cone to the height of 12,334 feet and is apparently connected on the western side with Fuego by a ridge of considerable altitude. Fuego, 12,603 feet high, has at its summit two peaks of similar appearance and nearly equal size, one of which is always enveloped in smoke.

San Jose de Guatemala, the chief seaport of Guatemala, is only an open roadstead and derives its importance from its connection by railway with the city of Guatemala, 72 miles distant by rail. It is a town of about 2,000 inhabitants; the houses composing it are built among the trees on a dark sandy beach. None of the houses are conspicuous from the sea, except a large white storehouse and a galvanized-iron storehouse at the outer end of the pier. In fine weather from a height of 30 feet above the sea these buildings may be clearly distinguished at a distance of 12 miles. These buildings form the only marks on the coast for the port by day, but the volcanoes Agua and Fuego, above described, are excellent marks for making the anchorage. The coast line is low, and low land extends back some 15 to 20 miles.

The town is lighted by electricity, and there is a row of 12 lights on the beach, extending from westward to the eastward of the pier, which forms a dark spot in the middle of the row. The lights of the town are not to be depended on; in fact, are quite unreliable as guides by night.

A fine iron pier 1,152 feet in length, built on screw piles, extends outside the surf for the accommodation of lighters and small vessels. A tramway runs from the end of the pier to the customhouse. Boats land at the end of the pier, and passengers ascend vertical iron ladders; in bad weather they are hoisted in a cage.

Cargo is handled by means of four 5-ton cranes, and one double 16-ton crane for bridge materials and boilers. All imports have to be checked through the customhouse at the port, then forwarded to the customhouse at the capital, where it is released to owners. Passengers and baggage are registered at the customhouse at the port.

Several lighters are used for loading and discharging cargo, and they are towed to and fro by a tug belonging to the port. When not in use they are moored in line outside the surf, about half a mile south of the pier end. As they show no lights, they constitute a danger to strangers.

The anchorage is in 9 to 13 fathoms about 1 mile from the shore; the farther off from the beach the less the swell will be. It is desirable to lay out a stream anchor if a prolonged stay is made, for otherwise when the ship is swung to the sea breeze she will be broadside on to the swell from the southeastward and roll heavily.

Supplies.—Fresh provisions and water are cheap and abundant, with the exception of vegetables, which are rarely to be had. Water is taken on board in casks. Coal is not procurable. Ballast is almost impossible to obtain.

Tides.—The lunitidal interval is 2 hours 50 minutes; springs rise 9 feet, neaps $4\frac{3}{4}$ feet.

Tidal streams are very strong, and change with the tide by the shore.

Buoys.—Two white spar buoys are moored off the pier and are used for floating hoses for oil ships.

The western of these is situated south-southwest from the pierhead distant 1,000 yards, and the eastern at the same distance south of the pierhead. Several small red mooring buoys for local vessels are established inshore of the western spar buoy.

Communications.—The mail leaves every day by rail for the city of Guatemala. There is only one train a day each way. The Pacific Mail steamers touch here three times a month, going both north and south; the Kosmos Line also calls here once a month.

There is telegraphic communication with Guatemala City, and overland to the United States and other parts.

Telegraph cable.—The submarine cable from Salina Cruz to La Libertad lands at San Jose, about half a mile eastward of the pier.

Trade.—San Jose is stated to be the most important commercial port of the Republic of Guatemala. The principal exports are coffee, sugar, hides, rubber, and mahogany; the principal imports are corn, flour, cement, coal, salt, railroad material, and general merchandise.

Health, quarantine.—Reports vary on the health of San Jose de Guatemala. Quarantine is maintained by the captain of the port, who will not allow passengers or freight to land unless the ship has a clean bill of health. There is neither hospital nor doctor.

Winds and weather.—As on other parts of the Central American coast, the winds at San Jose de Guatemala are generally from south-southeastward to westward from 10 a.m. to 9 p.m.; a short interval of calm follows, and is succeeded by light winds from northward to northeastward. From July to October southwesterly and westerly winds prevail, with heavy squalls and frequent rains.

Directions.—In making San Jose de Guatemala the peaks of Agua and Fuego Volcanoes are excellent guides, but if they should not be visible, as is generally the case from 10 a.m. until sunset, the land must be followed at a distance of about 2 miles until the pier and Government house are seen. Care must be taken in shaping courses, as the currents run with a strength of $1\frac{1}{2}$ knots; these currents may be mostly tidal streams, but they appear to be influenced by the

winds, sometimes running for some days to the eastward and then for some days to the westward.

Sailing vessels should guard against squalls, which come down over the mountains with great force, accompanied by heavy rain, thunder, and lightning; they occur pretty regularly every night during the summer season. From June to October a sailing vessel should anchor sufficiently far from shore to permit her to beat off with facility with southerly to southwesterly winds, which often blow with great force and raise a very high sea.

Istapa, at the mouth of the Michatoya River, 6 miles eastward of San Jose de Guatemala, though formerly a place of some importance, is now deserted. There is a breakwater on the eastern side of the entrance. The place is said to be unhealthful.

A railway connects Istapa with the main line between San Jose de Guatemala and Guatemala City.

Vessels going to Istapa must enter and clear at San Jose de Guatemala.

Anchorage is in 11 to 13 fathoms, muddy sand, about $\frac{1}{2}$ mile from the shore.

Coast.—From Istapa the coast trends about east-southeastward for 56 miles to Acajutla, and consists of a beach of grayish sand, backed by a well-wooded shore interrupted in a few places by rivers, the largest of which are the La Paz and the Esclavos; the entrances of the rivers are generally indicated by the white trunks of mangrove trees, but none is of importance.

The surf is very heavy upon all this coast, especially after a few days of strong southerly wind. It is believed that no sunken dangers exist off it, and the soundings indicate great regularity in the bottom, which apparently consists of muddy sand.

Current.—The usual direction of the current appears to be eastward, following the coast, with a velocity of $\frac{1}{2}$ mile an hour.

SALVADOR.

The República del Salvador extends from the River La Paz about 160 miles eastward to the northern side of the gulf of Fonseca. It is the most densely populated of the Central American Republics, the population in 1914 being 1.225.835.

The coast presents in general a belt of low rich, alluvial land, varying in width from 10 to 20 miles. Behind this and presenting an abrupt face seaward is a range of mountains, or, rather, a broad plateau about 2,000 feet high. Along this plateau there are not less than 11 volcanoes standing nearly in a line from southeastward to northwestward.

The principal stream is the Rio Lempa, which is hopelessly barred.

Besides La Union, a fine harbor, the ports are Acajutla and La Libertad, mere open roadsteads, and only of importance from their proximity to the cities of San Salvador and Sonsonate. La Concordia is the port of the town of San Vicente.

San Salvador, the capital, with 66,000 inhabitants, has been several times destroyed by earthquakes.

Acajutla is the port of Sonsonate, 8 miles in the interior, and the two places are connected by a railway which extends to San Salvador, passing through Nejapa and Armenia, with a branch line to Santa Ana. There is one train each way daily, and the whole journey occupies about six hours. The roadstead is merely an open bay, only partially sheltered by the reef of Remedios Point, and quite exposed to all winds from the westward; these occasionally send in a heavy sea, hence it is not considered a desirable anchorage, especially in winter.

The old village of Acajutla is shown on the plan; the village and flagstaff remain as landmarks. The new port is at a small cove about 1 mile to the northward. A large new iron pier, roofed over at the outer end, runs out from the shore in a west-southwesterly direction to the 3-fathom line. The pier is from 20 to 25 feet above low water, and, near its outer end, both sides are fitted with vertical iron ladders for landing. There is also a cage for landing passengers. The new village and railway station are at the inner end of this pier.

In 1901 a wreck was reported to lie 250 yards, 316°, from the new pier, and partly visible at low water. Its position was indicated by a black cylindrical buoy in 16 feet of water.

Anchorage.—The best anchorage is with the pier bearing 61° to 66°, in from 12 to 8 fathoms, according to season, anchoring farther out in winter. Men-of-war should anchor in about 8 fathoms, mud and sand, with the end of the new pier bearing 40°, about 1,200 yards.

The frames of the hull of an iron hulk lying sunk 75 yards outside and 30 feet westward of the pier form a menace to boats using the pier.

Tides.—It is high water, at full and change, at 2h. 55m.; springs rise 9.5 feet, neaps, 5.1 feet.

Supplies.—Fresh provisions can be had from Sonsonate on giving two days' notice. The water is not recommended for drinking. The Salvador Railway Co. keep a stock of about 110 tons of patent fuel. There are no coal merchants or coal warehouses.

Communications.—The Pacific Mail steamers call at this port three times every month going north and south. The Kosmos Line calls once a month.

Directions.—The town of Acajutla is difficult to make out until within 5 miles; the best guide is to bring the volcano Isalco on the

bearing of 45°, which will lead in until the port is made. If the volcano be obscured, the large shed on the outer end of the new pier is a good mark and is visible from a distance of 5 or 6 miles. This volcano, situated about 18 miles from the coast, is 6,328 feet high, and although there are higher peaks behind, it is easily recognized, being an active volcano. The column of smoke and steam constantly ascending from it and the frequent eruptions of molten lava render it conspicuous both by day and night. It is also not of sufficient height to be so frequently hidden by clouds as are the more lofty mountains in the interior. Ships should not enter the port at night on account of dangers to navigation and poor harbor marks.

Acajutla Light, group occulting white, visible 23 miles, is exhibited at a height of 181 feet from the roof of a house 1,750 yards 100° from the new pier. The light has been reported unreliable. Two fixed white lights are shown on the end of the pier.

The bearing of Remedios Point will be a guide as to distance off shore when taking up anchorage.

Caution.—When rounding Remedies Point from the eastward, the land should not be approached within 4 miles as long as Black Rock bears to the westward of 6°, and afterwards, a vessel should keep outside the 10-fathom line.

Remedios Point is a low cliffy headland, thickly clad with mangroves, and easily recognized. A reef and shoal water extend for 1 mile in a southwesterly direction from the point, the water shoaling from $4\frac{1}{2}$ fathoms at that distance to $1\frac{1}{2}$ and 2 fathoms a little closer in. Soundings are wanting in this locality, and vessels should approach Remedios Point with caution.

Black Rock is square shaped, 25 feet above high water, and lies close off Remedios Point. Three conspicuous bowlders lie ½ mile north of Black Rock.

East Rock, showing about 8 feet above high water, lies 1.2 miles 138° from Black Rock. It is in the midst of breakers which extend from the shore for 1 mile in a southerly direction.

Reef Rock, a small rock above water, lies about ½ mile 134° from East Rock.

Sacasa Rock, on which the German steamer Sacasa was wrecked in 1890, and on which the sea occasionally breaks at low water, lies 21 miles 141° from East Rock.

Current.—A strong current, $1\frac{1}{2}$ knots, was reported, in 1892, running about east by south at 1 to $1\frac{1}{2}$ miles off Black Rock, and setting on to and around Remedios Point.

Coast.—From Remedios Point to La Libertad, a distance of about 28 miles, the coast for the first 12 miles consists of an uninterrupted gray sandy shore with mangroves, terminating in a conspicuous rocky cape with a well-wooded summit; then follows a succession of

undulating points and perpendicular cliffs, separated by small beaches of sand and shingle, the land being of considerable elevation. The last 6 miles consists of a gray sandy shore with mangroves and is of moderate height.

This coast is known as the Costa del Balsamo, as the district produces the resin known commercially as balsam of Peru, so called from its having been sent to Lima for export to Europe.

The Bay of Majagual is only a small indentation of the coast, and the names does not appear on the H. O. charts of the locality.

La Libertad is the port of the city of San Salvador, with which it is connected by railway and also by a good cart road 26 miles long, but the importance of La Libertad has of late years diminished in favor of Acajutla, which is also connected with the capital by a railway.

The roadstead is exposed to the full sweep of the Pacific and can only be considered safe in fine weather or with northerly winds and should not be visited from July to October. At times the beach is smooth, but at full and change of the moon the rollers break at times in 4 or 5 fathoms at least ½ mile off the beach, making landing bad. These rollers, which set in suddenly, are apt to break cables unless vessels are anchored with a long scope.

An iron pier, 250 yards long, with a depth of from 3 to 4 fathoms at its head, facilitates landing. The pier is fitted with steam cranes, and two tramways extending along its length run into the custom-house. At the end of the pier is a conspicuous large white shed for receiving cargo. The town is small, with a population of about 1,500.

The sanitary condition of the town is reported as fair. The sickly seasons are at the beginning and end of the rainy season.

Pratique is obtained by sending to the captain of the port, who is the only authority to be visited. There is no hospital.

The anchorage is in $7\frac{1}{2}$ fathoms, with the end of the pier bearing 6° distant $\frac{1}{2}$ mile, and La Puntilla bearing 298°. To avoid fouling the submarine cables, the pier should not be brought to the westward of 350°.

Telegraph cable.—There is a cable leading from La Libertad. It is a branch joining the cable running from Salina Cruz to San Juan del Sur and is not marked by any buoys.

La Libertad Light, fixed white, is exhibited from a lantern on the roof of a shed on the end of the pier. It is usually extinguished at midnight. See Light List.

Tides.—The lunitidal interval is 3h. 05m.; springs rise 10 feet, approximately.

Supplies.—Cattle, poultry, and bread can be obtained, but no vegetables, and the prices are very high as compared with those of

Corinto. Water is conducted to the end of the pier, and is supplied without charge to vessels of war.

Communications.—There is regular steamer service several times a month. The town is in communication by telephone with San Salvador, and by telegraph with the rest of the Republic and other countries.

Directions.—Vessels from the southward should steer for Salvador Volcano on the bearing 12°, which will lead up to the roadstead; should the volcano be obscured by clouds the best mark is the large white warehouse covered with tiles. Gorro de Libertad, 6½ miles 332° from the town, is also a good mark. Soundings of 27 and 25 fathoms, mud, will be obtained at about 8 miles from land. decreasing gradually to the shore.

From either westward or eastward no better course can be adopted than to follow the coast with an offing of 5 or 6 miles, if the weather is favorable for doing so, immediately over the town there is no object sufficiently conspicuous to be visible from a distance.

Coast.—From La Libertad the coast trends nearly east-southeast-ward for 33 miles to the mouth of the Rio Lempa. The land, bordered with a belt of white sand, consists of an extensive plain from which rise in the distance the Volcanoes Vicente and San Miguel these are visible from a long distance at sea, and, together with Volcano Salvador, are of great assistance to vessels bound to Acajutla, La Libertad, and other ports.

Salvador Volcano has an elevation of 5,794 feet and can be seen at a distance of fully 60 miles from the land. Viewed from the sea it appears behind the mountain chain as a very large mountain with a flat summit, in shape not unlike the back of a tortoise. At its extremity is a peak.

Vicente Volcano, with an elevation of 7,040 feet, rises in the form of a truncated cone, which appears cleft when viewed from the eastward or the westward, one summit being more rounded than the other.

San Miguel Volcano rises to a height of 7,134 feet, and is a perfect cone with a very large base; its summit, the crater, is almost level, there being only a slight concavity in the middle. This mountain by its great elevation is conspicuous above all the hills in its vicinity; viewed from the westward it appears detached from the surrounding land.

Rio Jiboa is about midway between La Libertad and Rio Lempa. It is the outlet of Lake Ilo Pango, but is closed by a bar with heavy breakers.

La Concordia, at the entrance of the Lagoona de Jaltepeque, serves as the port of the town of San Vicente. An iron pier extends from the beach out beyond the surf line, and in smooth water, or

moderate weather, passengers and goods can be landed at its outer end. During the rainy season vessels lying at anchor off the pier roll heavily, and steamers discharging cargo usually put to sea at nightfall, returning in the morning to resume discharging or loading cargo.

San Vicente is connected by railway with the capital.

Rio Lempa, which enters the sea 20 miles 287° from Lempa Shoals, is the largest river in Salvador, but is only navigable for river steamers 24 miles from the mouth. The entrance is known by some large trees with white trunks, and tops almost bare, which rise above the lighter colored and lower woods, similar to the copse wood of northern countries. It may be found when coming from the eastward or southward by bringing San Salvador Volcano to bear 318°, or San Vicente Volcano 351°, and then running on either of these bearings will bring a vessel up to the bar. Coming from the westward, San Miguel Volcano, bearing 68°, will bring a vessel up to it.

The entrance is about half a mile broad, and barred by breakers which reach a mile or $1\frac{1}{2}$ miles off. There are only a few fishing huts on the left bank. A shoal at the mouth of the river extends three-quarters of a mile offshore.

Coast.—From the mouth of Rio Lempa the coast trends about 101° for 20 miles to Lempa Shoals.

Jiquilisco Bay and El Triunfo.—This bay and port, in the eastern portion of the Republic of San Salvador, has its entrance in approximately latitude 13° 9′ N., longitude 88° 29′ W., between the island of San Sebastian on the eastward and the peninsula of San Juan on the westward; the entrance points being nearly 2 miles apart, and the bay within very extensive, though mainly occupied by large low islands of which Recodo, Tortuga, and Espiritu Santo are the principal. Besides the main channel, deep narrow creeks surround nearly all the islands. The port of El Triunfo lies on the mainland shore, northwestward from the entrance points, and about 10 miles distant from them, following the course of the main channel.

Lempa Shoals—Bar.—The Lempa Shoals consist of fine gray and black sand, of such a nature that, when dried, a magnetized knife blade thrust into it comes out loking like a delicate brush. The shoals are of horseshoe shape, about 3 miles wide at the base, the two ends resting on the shore on either side of the entrance, the oval part extending offshore to the southward about the same distance. A narrow straight channel runs down from the entrance, dividing the shoal into two arms, which unite at the bar at the extreme southern part of the oval. Neither the bay nor the shoals appear to have altered much since they have been known, though it seems probable

that heavy weather, the action of the outside current, and the large volume of tidal water flowing in and out must occasionally cause temporary variations of depth on the bar.

Depths.—The bar has a depth at mean low water of about 14 feet; it is about 200 yards across between the outer and inner 3-fathom lines, and the width between the breakers over the shoal water on either side is less than 300 yards. To seaward, the depth increases gradually from 5 or 6 to 8 fathoms at 1 mile from the shoals. Vessels passing eastward or westward in the offing should not come into less than 10 fathoms. Within the bar the channel opens out considerably, but at 1,000 yards within there is a 16-foot patch in the channel. At 2 miles within the bar the channel narrows to 500 vards, with deep water between shallows on which the sea generally breaks; here the tide runs strongly, and there is often a short choppy sea dangerous for boats. From the 16-foot patch mentioned, there is water by the main channel for vessels of the deepest draft for a distance of 8 miles, to the head of Recodo Island, and a depth of 18 feet can be carried beyond El Triunfo at any tide. The bay extends some 15 miles northwestward beyond the part surveyed, its head being separated by a few miles only from Rio Lempa, with which there is every appearance of its having at one time been connected.

The channel leading up to the Rio San Miguel separates from the main channel between the entrance points and is deep for $2\frac{1}{2}$ miles, when it turns eastward into the San Miguel, where there is a bar with some 12 or 14 feet, beyond which it was not sounded by the surveying party.

Breakers.—There are usually breakers on each side of the bar at some period of the tide, even in fine weather, generally only single lines. In moderate weater, a single breaker occasionally sweeps completely across the bar. When there are no breakers, or when it breaks continuously across, it is difficult in the absence of buoys or any marks, except temporarily that of the *Brockley Castle*, wrecked off Point San Sebastian, to determine the exact position of the bar, though with proper buoyage and marks the bay might be safely entered by vessels of suitable draft, without the aid of a pilot. There is one buoy but it can not be depended on.

General aspect.—Inside the entrance for 6 miles by the main reach and 3 miles in other directions are sand beaches with woods and thick undergrowth extending back from high-water mark. Beyond these limits there is everywhere a dense growth of mangroves in swampy ground. A few miles inland to the northward, the land commences to rise toward the mountains.

Anchorage.—When clear of the shoal extending southward into the entrance from Pajarito Island, and above that island, there is smooth water and well-sheltered anchorage in the main channel for at least 6 miles in from $5\frac{1}{2}$ to 8 or 10 fathoms with a width of 1,000 yards between the 3-fathom curves. The holding ground is good and the tides regular. A good berth is off the Corral de las Mulas, where water may be obtained.

Tides.—It is high water, full and change, at the entrance, at 2h. 38m.; springs rise $7\frac{1}{4}$ feet, neaps $4\frac{1}{2}$ feet. At El Triunfo, the tide is half an hour later and rises 6 inches higher. The greatest strength of the tide is in the narrow part of the channel 2 miles within the bar, where it sometimes runs from 3 to 4 knots; elsewhere it is not strong.

El Triunfo is on a reach which divides the mainland from Tortuga Island. It is in telegraphic communication with San Salvador, the capital, and has a good wharf owned by the Government and leased to a company who desire to make this an important shipping port, for which it has many advantages. Coffee and dyewoods in small quantities are exported. Timber, agricultural machinery and materials, etc., are imported.

Supplies, etc.—Fruit, fresh meat, and fish can be obtained at the market, and there are several stores and warehouses.

Directions—Pilots.—In the absence of all buoyage or marks, no directions for entering Jiquilisco Bay can be given, though once inside the chart affords ample guidance. Vessels desirous of entering should telegraph to the El Triunfo Co. from La Libertad or from La Union, naming the time at which they will be off the bar, when a steamer will come out and pilot them in; or, a vessel may anchor off the bar and blow her whistle, which can generally be heard at the port. A sailing vessel with good local knowledge can safely enter with the sea breeze.

There are no natural marks that would be useful to the stranger.

Anchorage.—Vessels may anchor anywhere in the bay in from 5 to 10 fathoms of water. The holding ground is good, and the tides are regular. There is always a land and sea breeze. Probably the best anchorage is that off the Corral de las Mulas. Fresh water may be had here from a well.

Currents.—The tidal currents are regular and follow the direction of the different reaches. There are no cross currents. There are, in the strength of the ebb tide, some light swirls over the entire harbor, but they are feeble. In the narrow reaches, on the northern side of Recodo Island, the tides meet, but not always at the same point; this depends on the strength of the tidal current. The tidal current is the strongest in the narrow channel leading up from the bar, running sometimes as high as 3 or 4 knots an hour. There is quite a strong current outside the bar and on the outer edge of the flats; this generally sets to the westward with a strength of a knot or more.

Position.—The observation spot of the survey in 1897, near the customhuse in El Triunfo, is in latitude 13° 15′ 42″ N., longitude 88° 33′ 4″ W.

Communications.—There is irregular steamer communication.

There are two telegraph lines, one leading directly to the capital and the other to Usulutan, the capital of the department, and thence to the various parts of the Republic. From the capital, San Salvador, telegraph lines lead to La Libertad and thence cables to Salina Cruz, Mexico, which is in connection with all parts of the world.

All mail received from abroad goes to San Salvador and thence is sent to mail-distributing points of the departments. Mail is supposed to leave and arrive at El Triunfo three times a week. Mail arrangements are poor and unsatisfactory.

San Miguel River enters the sea about 4 miles eastward of the entrance to Jiquilisco Bay, with which it is connected by a channel inside. The mouth of the river is closed by a bar with heavy breakers. Within the bar the water is deep.

Coast.—From Jiquilisco Bay the coast trends easterly for 33 miles to Amapala Point. The shore is low for some miles, and then for a distance of 10 miles there is a bolder coast, with cliffs in some places, which is succeeded by a sand beach for the remaining distance. These sandy beaches give a very deceptive appearance to the land, especially at sunrise and sunset, causing it to appear at a less distance than is really the case, and the surf also appears to break farther from the coast than it actually does break; the land must, therefore, be approached with great caution.

Soundings.—The soundings are believed to increase gradually from the shore for a distance of some miles seaward, and vessels may anchor off the coast in case of a calm. This is, perhaps, the more prudent course, as the currents are variable, sometimes easterly and sometimes westerly, with a strength of about 1½ miles an hour.

Amapala Point, the western entrance point of the Gulf of Fonseca, is low and flat, about 4 miles long and from 1 to 2 miles broad; it is bordered by a reef of rocks and sand extending off about ½ mile and causing heavy breakers. At less than a mile outside the point the depth is from 6 to 8 fathoms.

The reef off this point is reported to extend farther from the shore than was formerly supposed.

From the point the shore bends northwestward to the outlet of a small river, and then turns northeastward 9 miles to Chicarene Point, on the north side of which is La Union.

Amalpala Point Light, occulting white, visible 15 miles, is exhibited at a height of 98 feet from a cylindrical structure 75 feet high on Amapala Point.

Conchagua Volcano, 3 miles westward-southwestward from Chicarene Point and about 13 miles from the shore, has not the conical form characteristic of the volcanoes of this part of Central America, but is a large mountain with two summits, of which the higher, 4,293 feet high, has a gradual slope and is in parts crowned with trees, while the other summit, 3,972 feet high, of a very rounded form, is covered with the herb named "sacate." This second summit is the true crater, but has been inactive many years.

The volcano presents a very remarkable appearance, which, together with its close proximity to the sea, prevents its being mistaken for any other mountain on the coast.

La Union, on the western arm of the Gulf of Fonseca, which is a landlocked harbor extending 7 miles in a northwestward direction, with a width of $3\frac{1}{2}$ miles, measured from shore to shore; on the northern side of the bay extensive mud flats, which dry at low water, contract the channel in places to less than a mile in width, while a mud flat in front of the town uncovers at half tide, virtually cutting off all communication by boat with the shore. This flat has encroached upon the anchorage since the survey in 1838, diminishing the depth slightly and shifting the channel a little to the northward. La Union has a population of about 5,000, is $4\frac{3}{4}$ miles from the entrance, and derives its importance mainly from its proximity to San Miguel, which, in February and November, when its fairs are held, becomes a busy commercial town.

The entrance to the port, between Sacate Reef and Chicarene Point, is about 1,200 yards wide. Sacate Reef exten is over ½ mile southwestward from the southwestern point of Punta Sacate Island and is covered at high-water spring tides. Chicar ne Point, on which there is a battery, terminates the eastern slope of Conchagua Volcano; a spit extends about 150 yards southeastward from the southeastern extremity of the point, with a least depth of 1¾ fathoms, about 60 yards from shore, and 3 fathoms, rocky bottom, 130 yards 136° from the southeastern extremity of Point Chicarene; about 35 yards farther in the same direction the depth is 9 fathoms. A rock lies about 300 yards southwestward from the point. It is believed that in general the depths in La Union Harbor are less than charted.

Colima Rock.—A pinnacle rock, of 31 fathoms, lies 1,200 yards northward of Chicarene Point.

Facilities.—There are 10 lighters of 15 to 20 tons, 1 of 6 tons, 3 of 65 tons, each owned by the railway company. There is an iron pier almost completed (1914), which is to have 30 feet alongside at low water. Fresh water will be piped to the pier.

Anchorage—Outer.—If intending to remain but a short time, vessels may anchor in the channel between the islands Conchaguita and Sacate and the coast. The best berth in that case will be about ³/₄ mile southward of the Chicarene watering place, in 6 or 7 fathoms, mud, with Chicarene Point bearing about 0°, and the northern point of Conchaguita about 112°. A berth should be selected as much as possible out of the violent sea, which prevails here when a strong sea breeze is blowing against the ebb stream, and it is recommended to moor north and south on account of the current.

Inner anchorage.—Vessels may anchor in almost any part of the port if care be taken not to be too close to the mud flat when the tide falls. Large vessels generally anchor just within the entrance, in 5 to 6 fathoms, mud, before the northern point of Punta Sacate is brought to bear 90°, avoiding Colima Rock, as they are here sufficiently sheltered from the heavy seas sent in by the strong winds from the southward, and are not exposed to the intense heat that prevails farther within the port. Small vessels generally anchor about a mile northeastward of the town, in 4½ fathoms.

Pier lights.—Two fixed red and one fixed white light are displayed on the pier.

Pilots.—The captain of the port directs vessels where to anchor; there are no pilots.

Tides.—The lunitidal interval at La Union is 3h. 15m.; spring range 10.5 feet, neap 5.7 feet.

Tidal streams are regular except in the rainy season, when the ebb continues rather longer than the flood. At the entrance to the port, between Chicarene Point and Sacate Reef, the ebb sometimes runs at the rate of 3 knots and causes a strong race, which has the appearance of breakers; in the vicinity of the town the rate is seldom over 2 knots. Northward of Conchaguita Island the flood divides into two streams, one flowing northward into the harbor and the other northeastward between Sacate and Perez Islands.

Supplies.—Beef, poultry, and oysters can be obtained at reasonable rates. As ships find great difficulty in watering here, the spring being accessible only at high tide, it is recommended to anchor and fill up at the spring 1 mile below Chicarene Point. Coal is not procurable.

Trade.—The exports are coffee, sugar, hides, and balsam; the trade of La Union is not large.

Communications.—The Pacific Mail steamers and those of the Kosmos Line call at La Union. The Ocos steamers of the two South American lines call at alternate intervals of one week and two weeks. A railway connects La Union and San Miguel.

Winds and weather.—The harbor being quite landlocked, the winds appear to be light, as a rule, and the heat is excessive. During

the dry season, from December to May, the wind sometimes blows very hard from the northward, and during the rainy season "chubascos." generally from the eastward, occur at about 11 p.m.

Directions for La Union.—A vessel approaching from the southward should steer to pass on the western side of Conchaguita Island, between it and the shore under Conchagua Volcano. When fairly in mid-channel, the entrance to the port will be seen right ahead between Punta Sacate Island and Chicarene Point. The point should then be steered for, and even brought a little on the starboard how if the flood tide is running, as the stream sets across the shoal northward of Conchaguita. As Chicarene Point is approached the northwestern extremity of Punta Sacate Island should be steered for on a 14° bearing which leads clear through the passage; the shoal spit extending from the point; and, on the other hand, Sacate Reef, which makes out from the southwestern point of the island, should be avoided.

After passing Chicarene Point and after rounding northward of Colima Shoal, steer about 310° between the shoals and up to the anchorage off the town. The least water in the channel, apart from the shoal above mentioned, is $3\frac{1}{2}$ fathoms at low water.

Islands.—Manguera, Conchaguita, Perez, and Punta Sacate Islands belong to Salvador, but are described in the following chapter.

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CHAPTER X.

THE GULF OF FONSECA AND THE COAST OF NICARAGUA.

General remarks.—During the dry season, which begins in November and lasts until May, the weather is fine on the Pacific coast of Central America. A light land breeze generally springs up before midnight, and in the forenoon the sea breeze sets in and lasts till sunset. Opposite the Lakes Nicaragua and Managua violent winds, called papagayos, varying in direction from north-northeast to east-northeast, come after the rainy season is over and reach their maximum of strength in December or January. These are often accompanied by a clear atmosphere and a cloudless sky. Their full force is seldom felt for more than 20 miles from the land, and it is recommended to keep 30 and even 45 miles from the shore if it can not be coasted within 5 or 6 miles. The gusts are said to attain their greatest force during the forenoon and to decrease about sunset; but too much dependence should not be placed upon this, since the U. S. S. Ranger experienced the heaviest squalls at night. The tendency of the wind under certain conditions to rush down the seaward slopes of mountain ridges should not be forgotten by vessels keeping near the land.

In the Gulf of Nicoya and on the coast below the northers are sometimes felt for a day or two. Late in the season the sea breeze freshens considerably toward sunset in and near the Gulf of Fonseca. During the months of March and April the natives clear the land by burning the brush, and sometimes the smoke is so dense that the mountain peaks are obscured. The dry season is called by the Spaniards Verano de la Mar del Sud (summer of the South Sea).

The rainy season lasts from May until November, but at first only occasional showers are experienced, generally in the afternoon. Later in the season calms and southerly storms prevail, the rain falls continuously, while thunder and lightning are at times incessant. From May to November, which is the rainy season, the weather is mostly bad, gales from the west and southwest, with thunder, lightning, etc., being frequent and at times violent. Some authorities refer to gales from the southeast and the south. At the anchorage at San Jose de Guatemala a southeaster brings in a heavy sea, and sometimes communication is impossible. This whole coast is at that season subject to very violent squalls of wind and rain, attended

with heavy thunder and very vivid lightning. These squalls are called "chubascos" and usually come from the eastward. The natives at Corinto expect a heavy southwesterly gale on or about October 4 and an interval of comparatively clear weather between July 15 and August 15.

Current.—The current during the dry season generally sets to the northwestward, but only off Guionos Point, where the velocity is sometimes 2 miles per hour, does it run uniformly in that direction. The officers of the Pacific Mail Steamship Co., it is reported, place no dependence upon the regularity of any currents near the coasts of Nicaragua and Costa Rica during the rainy season. The force of the current of Guionos Point would indicate some local agency, and as it is strongest when the papagayos are blowing, it may be that so much water is driven out of the gulf to the westward that an influx is occasioned from the southward. Crossing the entrances of the gulfs and bays the tides will be felt, and the set should be allowed for during thick weather or at night.

The Gulf of Fonseca, sometimes called Conchagua, is 19 miles wide at the entrace, between Amapala and Coseguina Points, and extends within the points 25 miles. It contains the port of La Union in Salvador, and those of Amapala and San Lorenzo in Honduras, and is the outlet of the Estero Real, a navigable river of Nicaragua. From the entrance points the shores run northeasterly 12 miles to Chicarene and Monypenny Points, respectively, and then turn sharply back, increasing the width of the gulf to more than 40 miles.

There are a number of islands in the gulf, but only the largest and those that by their situation affect the approaches to the inner waters of the gulf need be mentioned.

Landmarks and directions.—In addition to Conchagua and Coseguina Volcanoes, which plainly mark the entrance, San Miguel Volcano in Salvador and the Viejo group of mountains in Nicaragua will be in sight from the offing, and as the entrance is neared the cone-shaped peak of Tigre and the islands of Manguera and Conchaguita will be distinguished. Entering from the westward a vessel should give Amapala Point a berth of a mile and not go inside of 5 fathoms while running up the western shore. From the eastward, Coseguina Point should be rounded at a mile, and if bound for the Estero Real the same distance kept from the shore until the Farallones are abeam, when haul in for Monypenny Point, which may be passed close-to, in 14 fathoms.

Coseguina Point, the southeastern entrance point of the Gulf of Fonseca, fronts the sea in its southern and western parts with high cliffs, from which the land rises gradually to the base of Coseguina Volcano; the northern part is, however, low, consisting of a sandy

beach. The point is well defined, on entering from the southward, and can be passed at a distance of 2 miles, carrying 9 to 11 fathoms as shown on the chart, using the bearings of the crater, which has its high point well defined in a northwest-southeast direction. The point, 5 miles 21° from Coseguina Point, will open up and show steep-to after passing Coseguina Point; it should be left about 3 miles on the starboard hand, as there is but 6 fathoms at $1\frac{1}{2}$ to 2 miles off, as shown on the chart.

A wreck visible at all stages of the tide lies on the beach about 200 yards northwestward of Coseguina Point.

When abeam of this point the course should be changed to lead 1 to $1\frac{1}{2}$ miles to the southeastward of the Farallones. There is but 6 to 8 fathoms of water at 2 miles westward from Coseguina Peninsula. With a flood tide a good offing should be taken, as the stream might carry them into the Estro Real, toward which it flows with a strength of $1\frac{1}{2}$ to 2 knots.

Coseguina Volcano is 2,830 feet high, and can be seen, in clear weather, at a distance of 70 miles. The verge of the crater is $\frac{1}{2}$ mile in diameter, and the interior walls fall perpendicularly to a depth of 200 feet, where the bottom becomes flattish, with a small transparent lake in the center. The volcano now presents so remarkable an appearance, and in addition stands so near the sea, that it can not be mistaken for any other mountain on the coast.

Monypenney Point, 12 miles northeastward of Coseguina Point, is low, but the water is deep close-to; there is, however, less water than shown at a distance of 1½ miles. The anchorage to the eastward, where vessels may wait before attempting to enter the Estero Real, is well sheltered. Close under the point is a lagoon. The tide makes eastward with the flood and westward with the ebb off this point.

The Farallones, 10 miles northward of Coseguina Point and 4½ miles from shore, are a group of light-colored rocks, the middle one and largest having a rounded top, while the others are sharp and jagged; it is prudent to give them a berth of ½ mile, although no outlying dangers have been found.

These islands are charted correctly, and appear from the southward as one large dome about 60 feet high, with pinnacle rocks on either side 15 to 20 feet high. When see from the northward and eastward, the largest of the Farallones is steep-to on the right side and rounded on the left. There seems to be a ridge between the Farallones and the mainland with 1 to 2 fathoms less water over it than on either side of the ridge. The flood tide sets strongly on shore at 1 to 2 knots. A ground swell is very marked throughout this locality, causing breakers along the shore from Coseguina Point to Monypenny Point, and on the Farallone Shoal.

Manguera Island lies near the middle of the gulf, 9 miles within the entrance. It is oval in form, about 3 miles long and 2 miles wide, has cliff shores, is irregular, and rises to a height of 1,660 feet. A sandy flat with 12 to 15 feet of water extends ½ mile off the eastern side, beyond which are 4 and 4½ fathoms; and a rock, on which the sea occasionally breaks, lies off the southern side; from all other directions the island can be approached close-to. Off the southeastern point is Manguerita or Perigallo Islet, the narrow channel between having a depth of 10 to 13 fathoms.

This island is reported to be situated northward of its charted position; landing upon it is difficult to effect.

Conchaguita Island, 2 miles northwestward of Manguera and about the same distance from the western shore of the gulf, is 2 miles long and 1½ miles wide. The central peak, 1,680 feet high, throws out spurs to the northward and southward and these shoulders are well defined when approaching from the westward and southwestward. From the northeastern side of the island a flat, covered by from 1 to 2 fathoms of water, extends all the way to Perez Island; there are no other dangers near it. The channel westward of it, leading to La Union, has a depth of 6 and 7 fathoms, while that to the southeastward, the one usually followed to Amapala, has a depth of from 8 to 11 fathoms.

Perez Island, 2½ miles northeastward of Conchaguita, lies on the northwestern edge of the flat which extends from Conchaguita in a northeasterly direction to Disposicion Island, and northward to the shore. The flood here sets northeastward and has a tendency to carry vessels toward the flat.

Punta Sacate Island, about a mile northwestward of Perez, is of irregular shape, about 1½ miles in extent, and lies at the entrance to La Union, opposite Chicarene Point. Sacate Reef, which extends southwestward for over ½ mile from the southwestern point of the island, is covered at high water springs, and therefore presents no great danger. Between the island and the shore northward of it there is no safe passage, almost the whole space being occupied by a mud flat which dries at low water. At a short distance from its north side is Speck Islet, and from its east side an islet named Chiquita.

Garova, Disposicion, Sacate Grande, and Tigre Islands are east-ward of those just mentioned, in the northern part of the gulf, and among them are many islets and rocks of which no special mention need be made.

Sacate Grande, or Velasques Island, is the largest in the gulf and the only one not densely wooded to the summit. Several of its peaks are 2,000 feet high and covered with grass. It is separated from the mainland by a tortuous and narrow creek.

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Tigre Island is almost circular in form, with a diameter of about 3 miles. It is the highest of the islands in the gulf, its conical summit having an elevation of 2,490 feet. A 2½-fathom bank extends 2 miles from its southwestern side in the direction of Manguera, leaving between it and that island a channel 2½ miles wide and about 4 fathoms deep; extensive flats extend from the north and the east sides of the island, in the direction of San Lorenzo; on the western side is the channel leading to Port Amapala.

Shoal.—A 3½-fathom shoal has been reported to exist westward of Tigre Island, with the southwestern extremity of Knob Island bearing 5° 1,200 yards, and southwestern point of Tigre Island 149°.

Rock.—A rock of $3\frac{1}{2}$ fathoms is situated close off the northwestern extremity of Tigre Island.

The western extremity of Velasquez Island, open westward of Caracolita Island, leads westward of this shoal.

Knob or Caracolita Islet is low and flat, with a solitary tree near the middle, and lies close to the western side of Tigre; at 325 feet to the westward of it is a sunken pinnacle rock. A bank has formed around the rock and appears to extend toward Knob Islet. The wreck that formerly marked this rock has entirely disappeared, leaving the rock a serious danger to navigation, as there is nothing to indicate its position. This rock is generally marked by tide rips. The tide at a quarter ebb sets past the rock at the rate of from 2 to 3 knots an hour.

The tail of the shoal extending south from Disposicion Island, formerly shown on charts with a depth of 3 fathoms, no longer exists, and the eastern edge of the bank bordering on the channel is considerably more to the westward than the charts show, giving a wider channel all the way to Amapala.

Amapala, the only accessible port of Honduras on the Pacific coast, is at the northwestern end of Tigre Island, which protects it on the south, and has a fine harbor with good holding ground. The town, which has a floating population of about 2,000 or 3,000, occupies a narrow shelf on the northern side of the island at the foot of Tigre Mountain. A wooden pier, 400 feet long, extends out from the middle of the town; the beach is steep, and lighters can load with facility. Trade with the interior is carried on by means of boats through Cismuyo Bay and the esteros leading into it. All merchandise, regardless of final destination, is landed and carried into the customhouse for the assessment of import duties, after which that portion of the cargo destined for Tegucigalpa and other interior points is carried back aboard the lighters and transported across an arm of the bay and up an estuary to San Lorenzo, the terminus of the Tegucigalpa-Pacific highway, 16 miles from Amapala. Here it is placed on pack mules or loaded aboard ox carts and automobile trucks for further transportation. Two firms have an absolute monopoly of the lighterage business, due to the fact that they control practically the whole water front. They use a number of shallow-draft wooden cargo boats of from 10 to 30 tons each, which are rowed by native crews.

The United States is represented at Amapala by a consular agent. Anchorage.—The best anchorage is said to be immediately off the end of the pier. The anchorage was reported in 1894 to be more extensive than shown on the chart, the eastern edge of the shoal extending southwestward from Sacate Grande Island, being 500 to 600 yards farther to the westward, and the shoal of less extent than indicated on the chart. No report was made as to the depth of water at the anchorage, which former reports had stated to be less than given by the chart.

Good anchorage is found in a depth of $8\frac{1}{2}$ fathoms, with the pierhead bearing 152°, distant 500 yards.

Tidal streams.—At this anchorage the tidal streams run about north and southwest; the former or flood stream attaining a velocity of about $1\frac{1}{2}$ knots and the latter or ebb stream about $2\frac{1}{2}$ knots.

At the northern end of Manguera Island the flood stream sets east-northeast with a strength of about a knot; the ebb sets south-southwestward between Conchaguita and Manguera with a velocity of 1.7 knots.

Landing.—The boat landing is at the outer end of the pier, where there is always plenty of water.

Tides.—High water at full and change is at 2h. 56m; mean range 8.7 feet. The tides are regular.

Supplies.—Beef can be obtained, if ordered, but is of poor quality and expensive; vegetables are not obtainable; good bread can be had; poultry is plentiful, especially on Sunday mornings, when the people from the neighboring islands come to market with provisions. Water can be obtained from wells, but there are no facilities for getting it on board, and in the dry season the wells are quickly exhausted.

Trade.—The principal exports are silver and gold in bars and ores, coffee, hides, and india rubber. The imports are cotton and woolen fabrics, hardware, wine, beer, silks, and mining machinery. The bulk of the trade is with the United States.

Communications.—The Pacific Mail steamers call here twice a month each way. The Ocos steamers of the two South American lines call at alternate intervals of one week and two weeks. Local steamboats of small size ply between Amapala and La Union and San Lorenzo Bay. There is telegraphic communication between Amapala and the interior. San Lorenzo, at the head of San Lorenzo Bay, and La Brea, at the head of Cismuyo Bay, are connected by a cart road with Tegucigalpa, the capital of Honduras, a distance of

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83 miles, and thence with Comayagua, a farther distance of 62 miles. The latter place is 31 miles by mule path from San Pedro Sula, which is on the railroad from Puerto Cortez and distant therefrom 37 miles. The railroad connects with La Pimienta, 60 miles from Puerto Cortez. (Distance in statute miles.) The journey on mule back from San Lorenzo to the capital requires three days and from San Pedro Sula to the capital, seven days.

Directions.—When making for Amapala from the westward steer for mid-channel between Conchaguita and Manguera Islands, so as to bring the high conical peak of Tigre between them, bearing 62°, then run directly for it, taking care not to be swept by the flood stream northward of a line between it and the southern end of Conchaguita Island, as there are shoals on the port hand. When Disposicion Island has fully opened from Sacate Grande, the shoal will be passed, and Tigre Island will be a mile distant; course can then be shaped for Caracolita Islet.

The channel westward of Caracolita Islet is ‡ mile wide, and the lead should be freely used in it, as the edge of the bank is steep. The rock off Caracolita should be passed at 300 yards distance, then haul in again for Tigre, keeping about ‡ mile from the shore until the town opens, and avoiding the shoal off the north-western end of the island. The channel leading into Amapala appears to carry a least low-water depth of 4 fathoms. When approaching the port the direction and influence of the tidal stream must not be forgotten; the flood stream sets northward and toward the bank.

Coming from the southward, having rounded Coseguina Point, steer to the northward, giving the Farallones a berth of not less than ½ mile, and when Manguerita Islet (or Perigallo) is passed, bring it in line astern with the westernmost of the Farallones, then proceed as above. The western shore of Sacate Grande Island, a little open westward of Knob Islet, clears the bank extending south from Tigre Island.

The best time to leave Amapala is at the end of the flood and with a land breeze.

Cismuyo Bay, 5 miles northward of Amapala, is entered between Sacate Grande and Disposicion Islands; the shores are low, marshy, and covered with mangroves. La Brea, near the head of the bay, is a small collection of huts where merchandise to and from Amapala is transhipped in boats. La Brea is connected with the capital by road. There is no further information about Cismuyo Bay than the chart affords.

San Lorenzo Bay lies eastward of Tigre and Sacate Grande Islands, and the insignificant village of the same name is situated on the left bank of a narrow tortuous estero, 3 miles above the head

of the bay. The bay can not be made available for commerce until the narrow channel leading into it is marked with buoys and beacons. The course in is among banks and shoals for 6 miles before it nears any point sufficiently to make bearings available; 3 fathoms can be carried in at low water, but in several places the width of the channel is but little over 200 yards.

Vessels drawing under 12 feet might enter with the aid of the chart, but there is still danger, as the channel probably shifts, and several places were noticed in which the tide set with considerable force across the banks. Large vessels should not attempt the channel without planting buoys between the bar and Raton Island. Above Raton the channel is wide, and can be easily navigated; the anchorage here is always good, for, though the bay is open to the entrance of the gulf, the shoals and flats form an excellent breakwater.

The western shore of the bay above Sacate Grande Island and all the eastern shore except a small strip on Ratch Island are lined with mangroves. There are numerous esteros, but in none of them except that of San Lorenzo can boats penetrate beyond the low, swampy land.

Tides.—At the head of San Lorenzo Bay high water, full and change, is at 2h. 50m.; springs rise 12 feet, neaps 8 feet. The sea breeze raises the water at the head of the bay higher than at any other place in the gulf. On one occasion a rise and fall of 14 feet was noticed.

Condega.—From San Lorenzo Bay to the mouth of the Estero Real the shore continues low, and the water is so shoal that at only one point can 3 fathoms be carried to within 2 miles of the land. The natives call this place Condega, and it is reported that several vessels have loaded here with dyewood. Several rivers enter the gulf between Condega and the Estero Real, but they are either choked with bars and mud flats or too shallow, after a few miles, for anything but lighters and small boats.

Estero Real.—This broad and navigable river of Nicaragua has its source near Lake Managua and enters the gulf at the head of the large bay behind Coseguina Volcano. On the bar there are $2\frac{1}{2}$ fathoms at low water, and from the mouth as far as the junction of the Estero Palomina, 20 miles above, the depth is sufficient for the largest ships. Up to this point the tides are but slightly affected by the river current; consequently there is but little difficulty in ascending with the light prevailing winds. Above the Palomina the depth diminishes rapidly, and at $1\frac{1}{2}$ miles the stream is compressed between two rocks. This river has been ascended by a vessel drawing 10 feet for about 30 miles.

Dyewood, the only article of commerce, is cut and shipped in large quantities; the country contiguous to the watercourses is being rapidly stripped of it. Little in the way of supplies can be obtained in the estero, but ducks, curlew, and pigeons are plentiful; bullocks can sometimes be obtained. There is a spring near Nagascol, and another at Tampisco that uncovers at low tide, but the flow is so small that ships should water, if possible, before entering the river.

Directions.—The large bay into which the estero flows has shoals and flats over nearly all the upper portion, and the channel leading across them begins properly 7½ miles within Monypenny Point, being here about a mile wide and the distance from mid-channel to the southern shore 1½ miles. Having reached the entrance to the channel, a vessel should steer 152° until Conchagua Volcano appears over and just within the shore line on the southern side of the bay, and then steer in on this leading mark astern, edging off to the southward as the land dips so as to keep the volcano at all times over the visible land; this will keep the vessel in the curve of the channel until the mouth of the estero is fairly open.

To insure this change in the range, the height of the eye above the sea should be less than 20 feet.

Entering this bight on a dark night is not recommended unless Tigre and Manguera Islands can be made out. The ground swell is felt until nearly up with Cinder Point.

The ebb tide sets about 2 knots a little northward of west on Monypenny Point, and it is well to run well up with Tigre Island ahead when leaving on the ebb tide.

Playa Grande, on the left bank, 8 miles above the mouth, consists of a customhouse and a few huts. Five miles beyond the stream is narrowed between two ledges, but by keeping in mid-channel they will be avoided. Thus far the banks have been low and the country level, but 4 miles above the narrows Nagascol Hill rises from the south bank of the river, and a little above it ships generally lie while loading. After two or three bends a 2-mile reach succeeds, and at the upper end the Estero Palomina joins the main stream. The Tampisco Creek also enters this reach from the southward, ½ mile below the junction of the Palomina.

Tides.—At the entrance to the Estero Real high water at full and change is at 3h. 12m.; springs rise 11 feet.

NICARAGUA.

Nicaragua extends from the Gulf of Fonseca to Salinas Bay in the gulf of the Papagayos. Its population, numbering 550,000 in 1905, produces but little and requires comparatively little from the rest of the world. The number of whites is very small. The country is of importance on account of the magnificent line of lakes. The northern part of the Republic is mountainous, but the southern part, in which lie the lakes, is a vast plain about 200 miles long and 100 miles broad. The Sierra Madre Range, with many volcanic peaks, traverses the western part, broken by this plain and the lakes, but a narrow neck of land intervening between the lakes and the Pacific coast.

The coast of Nicaragua preserves a general southeasterly direction from the Gulf of Fonseca to the eastern boundary at the head of Salinas Bay, a distance of 170 miles. The volcanic peaks and mountain ranges near the sea are so distinctive in outline or surroundings that they are easily recognized when approaching the coast in clear weather, and as they become visible occasionally during the rainy season, when observations may not have been obtained, the advantage of being able to distinguish them can well be understood.

Viejo or Chinandega Volcano, 5,670 feet high, 43 miles from Coseguina Point and 17 miles inland, next to Ometepe is the highest mountain in Nicaragua; it stands directly behind Corinto, which is the most important seaport. The summit is very sharp, and in appearance has been cut off at an angle. On the western side two small peaks rise near the base, while on the other side a high ridge shoots out for 2 or 3 miles and then sinks down to the foothills. Viejo is really the first of the Marabios Range, which extends nearly east-southeastward, and terminates in the volcano of Momotombo, on the shore of Lake Managua. The volcanoes of Telica, San Jacinto, Rota, Las Pilas, and Assoco are also included in this range, but as Viejo and Momotombo are higher than any between them they alone are especially valuable as landmarks.

Momotombo, an active volcano, 3,910 feet high, is cone-shaped and so regular in outline that it resembles a pyramid, and therefore can not be mistaken for the lower and more rugged peaks to the left, especially as it terminates on the east the chain of mountains. When viewed from the sea at some distance southward of Corinto, Momotombo appears as an immense isolated mountain, but when seen from Cardon Island it is joined to Assoco, a volcano of less height, the two mountains then showing as perfect cones.

Las Pilas has two rounded summits of almost equal height, presenting a saddle-shaped appearance; it is not sufficiently lofty to be seen from the offing.

Telica is the most remarkable of the mountains between Las Pilas and Viejo; it is a cone of extremely regular outline, which appears to be connected with Viejo, of which it has about half the altitude, but from which it is in reality separated by a wide interval containing the mountain Santa Clara.

Cerros de Managua.—This long rounded ridge, showing a regular curved outline for nearly 15 miles, is 29 miles 152° from Momotombo and parallel with the coast, with an elevation at its highest point of 3,030 feet.

Mombacho Volcano, 4,305 feet high, rising from the shore of Lake Nicaragua, is very irregular in outline and shows two peaks when seen from the westward, over the Cerrcs de Managua, and three when seen from the southward. The eastern summit is the higher and is remarkably sharp.

Cmetepe Volcano, 5,680 feet high, 27 miles 132° from Mombacho and 23 miles from the coast, is in Lake Nicaragua, and shows over the high land between the lake and the Pacific as a perfect frustum of a cone; it is active and often concealed by dense volumes of smoke. The little port of San Juan del Sur is directly in front of it on the coast.

Madera, about 8 miles southeastward of Ometepe, is a saddle-shaped mountain; the eastern and higher summit has an altitude of 4,681 feet.

Vessels making the land in front of Ometepe and Madera will have the mountains of Costa Rica in sight to the eastward.

Coast.—From Coseguina Point the shore for the first 6 miles, sloping gradually from the base of the Volcano Coseguina, breaks squarely off into the sea and forms an almost perpendicular line of cliffs 200 feet in height. The hills here recede from the shore, and 9 miles from the end of the bluffs is a lagoon or river mouth, with an island across it and shoal ground $\frac{1}{2}$ mile out, on which the sea often breaks. A shoal of $2\frac{3}{4}$ fathoms lies 7 miles southeastward from Coseguina Point and $1\frac{1}{2}$ miles offshore.

Mesa de Roland, 19 miles from Coseguina Point and 4 miles inland, is a flat-topped hill 1,000 feet high, which from the southward appears to rise on each side abruptly and near the top perpendicularly. Behind it are hills of greater elevation, and therefore from directly seaward it is visible but a short distance.

Speck Reef, lying about 20 miles southeastward of Coseguina Point and consisting of shoal patches with deep water about them, extends 3 miles along the beach and makes out 1½ miles. At the western end, 1 mile offshore, are several rocks awash. Westward of the rocks, 1 mile distant, is a 3-fathom shoal, ½ mile across, with 6 and 7 fathoms around it; from it the Mesa de Roland bears about 36°. The outer reef is extremely dangerous, as it does not break at half tide even with a heavy swell, though the sea breaks furiously on the inner reef at that time.

Burra Grande Reef, 254 miles from Coseguina Point and 14 miles from Corinto Lighthouse, is 1 mile in length, parallel with the coast, and 4 mile in width, with a depth of about 14 fathoms, but with rocks

nearly awash. The outer edge is $1\frac{1}{2}$ miles from the shore, with soundings of from 5 to 8 fathoms close to it. Inside the reef is a narrow channel with 5 and 6 fathoms, but as there are other shoals on the inshore side, the passage should never be attempted; one of these shoals, called Padre Ramos, with less than 2 fathoms over it, bears 95° from the southern end of Burra Grande, and its outer end is $\frac{3}{4}$ mile from the shore.

From Burra Grande Reef, Corinto Lighthouse bears 126° and Mesa de Roland 357°, and it is from this vicinity that the latter has the appearance described above.

Limon Island lies at the mouth of a small river, 27 miles from Coseguina Point, and is low, flat, covered with trees, and encircled by a beach of gravel of whitish color. The islet is only 16 feet high, but the trees upon it render it visible at a distance of 8 miles; it is connected with Aserradores Island by a rocky bank under water, upon which the sea almost always breaks, and over which there is so little depth that it completely closes the channel.

It is said that a number of vessels have been lost on Burra Grande Reef, or amongst the shoals close to Limon Island, by mistaking the latter for Cardon Island in front of Corinto. The lighthouse on Cardon Island, and the fact that Limon is densely wooded while Cardon is comparatively bare, should prevent such disasters in the future.

Coast.—From Limon Island the trend of the coast is about southeasterly along Aserradores Island, which is low and wooded, with a sandy beach. A near approach to this shore is not recommended, because if the wind should fall light the current and swell would soon drift a vessel on shore. A safe distance is 5 miles, in not less than 10 fathoms water. During the winter, when the wind sometimes blows from south to southwest, with rainy weather, there is also danger in remaining at anchor off it, as the sea runs very high.

Corinto Harbor is formed by the junction of the Realejo River and Doña Paula Estero, and extends around the southeastern end of Aserradores Island, between it and the mainland on the eastward and southward and Cardon Island on the southwestward. Aserradores Island is often referred to in descriptions of the port, but it should be borne in mind that being separated by only a narrow creek it can never be distinguished from the mainland. The island is low, level, and densely wooded, with a narrow sand beach along its whole extent. The depth of water in the harbor is from 5½ to 8 fathoms. A railroad through the cities of Chinandega and Leon connects it with Managua and Granada. A pier alongside which steamships will be able to lie and discharge is being built at the northern part of the town; it will be connected with the railway. There is a United States consular agent at Corinto.

Cardon Island is \(\frac{3}{4}\) mile long in a northwest-southwest direction, about \(\frac{1}{4}\) mile wide, of a reddish-brown color, almost bare of trees, about 35 feet high, and nearly level. The northwestern end, known as Cardon Head, is faced with perpendicular rocks, and just outside of them is Ponente Rock, resembling a tower. As Cardon Island is outside of the lower end of Aserradores Island, and nearly parallel with it, the main entrance to the port, called Cardon Channel, is open to the northwestward between them.

The landmarks for making the port in clear weather are the volcanoes of Coseguina, Viejo, and Momotombo; Viejo, owing to its height and position, has been seen by vessels 50 miles off Corinto. All the peaks between Viejo and Momotombo are visible from the offing, and as the port is neared Assoco will come nearly in range with Momotombo and become, like it, conical in appearance. For a considerable distance, above and below Corinto, the coast is low, and behind it is an extensive plain rising toward the interior.

Outer anchorage.—The anchorage outside Cardon Island is safe only during fine weather; consequently when it is intended to make a stay, it is more prudent to enter the port. A very large vessel should anchor with the northern point of Cardon Island bearing between 92° and 96° in 6½ to 8 fathoms, bottom mud and black sand; if in a position more northward than this, the same soundings will be found at a greater distance from the land, but not from the shoals, and if more southward a heavier sea is generally met with.

In the winter months, when the papagayos occur, sailing vessels must often wait for days, lying outside at anchor, for an opportunity to enter, as the sea breeze that usually blows in the afternoon then entirely fails. When, therefore, the wind changes to southwest the anchor should be weighed as quickly as possible and sail set, as the sea breeze is generally of only short duration, barely sufficient to bring the ship to its anchorage in the port.

Tides.—It is high water, full and change, at 3 hours 6 minutes; springs rise, 11 feet.

Tidal streams.—In Corinto Harbor the tidal streams are to be guarded against. At the outer anchorage the flood stream sets strongly from northeast to east-northeast, and the ebb in the reverse direction, with a mean velocity of about 0.8 knot, but sometimes reaching 2 knots.

Cardon Light, flashing white, visible 14 miles, is exhibited at a height of 87 feet from a white circular concrete tower with red lantern on the northern point of Cardon Island. A building with red tile roof stands just southward of the light.

Buoys.—Several buoys have been established in the harbor, but at the latest reports all were carried away.

Bar Range.—The outer or bar range is formed by the church steeple of Corinto in line with a white mast surmounted by two triangles, points together, painted white, erected just above high-water mark on the southwestern end of Aserradores Island. The range bears 84°, and leads across the bar with a least depth of 4¾ fathoms at mean low water.

Doña Paula Range is formed by two white beacons on Pemta Scaco Peninsula, located just to the westward of Doña Paula House, and in line bear 118° 30′. The front beacon is a tripod surmounted by a circular cage. The rear beacon is a mast surmounted by a triangle. This range leads into the harbor through the channel along the eastern side of Cardon Island.

Caution.—It should be observed that this range clears the northeast tip of Cardon Island (head) by only 10 feet, and just clears the 3-fathom line to the northwest of Cardon Head. This range, therefore, can not be kept closed in entering this channel from the northwest when abreast the shoal and lighthouse.

There is a two-story house (Doña Paula) with a red tile gable roof on Mount Doña Paula. This house constitutes a conspicuous mark in the daytime, when entering the harbor off Cardon Head, and is on the Doña Paula Range line.

Encantada Island Range.—Formed by two white beacons erected on Encantada Island, and are in line bearing 63° with the highest part of the bluff on the southeastern end of Cardon Island astern. The mark on the front beacon is a cross "X," and the mark on the rear beacon is a triangle. Some difficulty may be experienced in picking up this range in the morning when the sun is behind it, but it can usually be seen while on the Doña Paula Range as soon as the harbor beyond the Cuartel opens.

Caution.—The ebb has a tendency to set a vessel directly on Cardon Head. During the flood guard against a set toward the shoal to the northwest of Pemta Scaco Peninsula.

Directions.—Vessels entering from the northward, when 3 or 4 miles off, should bring Cardon Head lighthouse to bear 105° and steer for it until the bar range is on, bearing 84°. Steer in on this range until Mount Doña Paula House and the Doña Paula Range marks open to the left of Cardon Head, or until the lighthouse bears 123°, then quickly turn to starboard, about 3 points, and, keeping the range open to the eastward, steer to clear Cardon Head and the shoals to the northward by 75 to 100 yards. With the lighthouse abeam, distant 100 yards, immediately haul to the southward almost parallel with the eastern shore of Cardon Island, close promptly the Doña Paula Range and keep it closed. When abreast the highest point of the rocky bluff on the eastern extremity of Cardon Island, haul up

slowly to the northward and bring this point astern, making good the course 63°, until in mid-channel with Icacos Point abeam, distance 300 yards, then follow the trend of the coast of Aserradores Island to the desired anchorage.

The 5-fathom channel abreast Cardon Head is 225 yards wide, and the 3-fathom channel 275 yards wide. Navigators are advised that when the house on Mount Doña Paula and the Doña Paula Range marks are seen open to the left of Cardon Head, the vessel is then already on the inner range. Better water is obtained and the shoal forming to the southward of Sawyer Bank is avoided by standing well in on the Doña Paula Range before hauling up for the anchorage.

Or, if coming from the southward, steer in with Cardon Island lighthouse, bearing 90°, until the watch tower at Cape Austro (southern end of Cardon Island) bears 113°, then stand across the bar on a 65° course until the bar range is closed, bearing 84°, and then proceed as described above.

At night when the bar range marks can not be seen, stand in with the lighthouse bearing 105° until the trees on the southern end of Aserradores Island bear 96°, then head for these trees until the lighthouse bears 123°, then quickly turn to starboard and proceed as directed bove. In case the Doña Paula Range marks can not be seen, keep the pof Cardon Head on the bearing 118° 30′, or 298° 30′, as the case may be, while running the channel along the eastern side of Cardon Island.

Leaving Corinto.—From a point in mid-channel abreast Icacos Point, steer for the highest point (northern end) of the rocky bluff on the eastern extremity of Cardon Island, bearing 243°, and having the Encantada Island Range on directly astern. Haul out for the entrance in time to close Doña Paula Range marks when the tip of Cardon Island is right ahead, bearing 298° 30′. Stand out with this range astern until abreast the "rock awash," then steer to pass 100 yards from the lighthouse.

At night, or when the inner range marks can not be seen, steer for the highest point, as above, until the tip of Cardon Head bears 290°, then turn to starboard slowly and head for it, rectifying the bearing (298° 30') if necessary. The use of a searchlight is recommended.

The Bar Range leads across the bar in the best water, the least depth found being 43 fathoms at mean low water, which is also the depth at the intersection of the bar and inner ranges. Cardon Head is clear and step-to to the eastward, 9 fathoms being found a few yards from the water's edge.

Anchorage.—The port is completely sheltered from bad weather except from the direction of False Entrance. Merchant vessels waiting to dock habitually anchor in midstream. Streamers for

Panama, southbound, leave the dock and anchor in the stream for the night at 5 p. m.

A very good anchorage for warships, out of the way of merchant vessels, is in $5\frac{1}{2}$ fathoms of water, with the southwest corner of the dock bearing 323° and the northwest beacon of the Doña Paula Range bearing 205°. Farther down the meeting of the ebb-tidal streams of the several esteros causes a vessel to ride uneasily at her moorings.

The bottom is of hard sand, and vessels swinging at single anchor are likely to foul it should it project above the bottom, resulting in a reduced scope and increased probability of dragging. It is therefore recommended that vessels lying in the stream moor with a swivel, and in the seasons of Chubascos, without a swivel, with open hawse to the eastward.

Shoal.—A shoal with a rock on it having a least depth of 2 feet over it at low-water spring tides, is located in Encantada Creek, about 350 yards within the entrance.

Pier.—The largest pier is owned and operated, under a concession from the Nicaraguan Government, by the Central American Commercial Co., an American corporation. This pier extends from the shore at the upper part of the town, in a 153° direction for about 400 feet, and then in a 186° direction for 513 feet. The outer section of the pier is 51 feet wide and the diagonal or shore section is 18 feet wide. The pier is built on concrete piles diagonally cross braced. Extending the greater part of its length is a shed with a red corrugated-iron roof. Along the outboard side of the shed is a double track and switch on which cars can be brought alongside of vessels moored to the pier. The following are the depths at mean low water alongside the pier.

Outer edge, main section: Southern end, 30 feet; middle, 29 feet; northern end, 32 feet.

Inner edge, main section: South end, 15 feet; middle, 15 feet; north end, 26 feet.

Outer edge of diagonal section: Middle, 16 feet; shore end, dry 2 feet.

At the landing on the shore side of the pier there is a staff tide gauge with the 12-foot mark even with the underside of the horizontal, longitudinal, concrete stringer. On this gauge mean low water is at the height of 4.3 feet.

Quarantine regulations.—The General Regulations of Ports, article 112, states: "Ships of war may anchor where their commanders may dispose, and they shall not be visited until after some one of their officers may have presented himself at the commandancia and given notice of the port of departure, object of the trip, and other information that may be inconformity."

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Recently the practice in the port of Corinto has been that when a war vessel, of whatever nationality, arrives in port, soon after anchoring the officer (mentioned above), accompanied by the medical officer, shall communicate with the commandante and the sanitary officer of the port and inform them of the health of the crew.

Merchant vessels entering the port are visited by the captain of the port and the quarantine officer. Pratique is granted by the captain of the port, who is also the commandante de armas and the senior local government official.

The Isthmian Canal Commission maintains in this port a medical officer on detached duty from the Canal Zone, whose duty it is to see that all the quarantine regulations of the above commission are carried out by all south-bound steamers carrying passengers to Balboa and Panama, as there exists a six-day quarantine at these ports against Corinto.

All steamers en route to Balboa must leave the Central American Commercial Co.'s dock at 5 p. m. and anchor in the stream 1,000 yards away from the dock. They can dock again at 6 a. m. No passengers are allowed to visit the town, or they forfeit their right to land at Balboa until the unelapsed time has expired.

All passengers embarking at Corinto for Balboa, Ancon, or Panama are required to spend the unclapsed time at the quarantine station in Panama Bay. Since these steamers are often a day or more taking on cargo at Corinto, the advantage of embarking promptly upon her arrival at Corinto is evident, as is also the advantage of placing one's ship in quarantine six days before the contemplated arrival at Panama.

Water is brought by rail from Ameya, a small town in the interior, in tank cars and delivered to the vessels at the pier. There is no water boat here for the delivery of water to vessels in the stream.

Fresh water, perfectly good for steaming purposes, can be obtained in ships' boats from Barquito, a landing place on an estero of the same name, discharging into Doña Paula Estero, distant about 4 miles from the anchorage. It is best to fill the boats on the ebb tide, as there is less likelihood of its being salt.

Provisions.—Beef of a fair quality can be obtained in moderate amounts upon 24 hours' notice. White potatoes (native) in small amounts can be obtained from the interior upon two or three days' notice. Other varieties of fresh vegetables are scarce at any season of the year. Fruits, including bananas, oranges, and alligator pears, are plentiful at certain seasons of the year. Flour, sugar, and coffee of a fair quality and at reasonable prices can be purchased. Chickens and turkeys were formerly plentiful, but have become scarce and are now high in price.

Coal.—There is no coal at Corinto. A supply of fuel oil only is kept on hand by the railroad which operates oil-burning locomotives.

Time.—There is no standard time kept at Corinto. Railroad time, the local mean time of the eighty-seventh meridian, is probably in most general use.

Communications.—There is frequent steamer service by several lines. From Corinto a railroad extends through the cities of Chinandega and Leon to Leon Viejo on Lake Managua, 58 miles; thence the connection is by steamboat with Managua, the capital, situated on the southern shore of that lake; thence by railroad to Granada at the head of Lake Nicaragua, 33 miles; from Granada a steamer makes three trips a month to the foot of Lake Nicaragua, from which point the small San Juan River steamers make frequent trips to San Juan del Norte or Greytown, on the eastern coast.

Castañon Bluffs, at the northwestern end of the Pemta Scaco Peninsula, are 47 feet high; to the eastward are several wooded hills of twice that elevation. Mount Doña Paula, 73 feet high, rises from the shore at the mouth of Doña Paula Estero, 7 mile eastward of the bluffs.

False Bar Channel is the narrow entrance to the port between the Castañon Bluffs and the southeastern end of Cardon Island. The depths in this channel are constantly changing, and its use, even with the chart, is not recommended, although it appears to carry a practicable depth of 4 fathoms.

Castañon Shoal, covering the False Bar Channel, has only from 3½ to 4½ fathems over it; therefore vessels coming from the eastward should keep 2 miles from the land, or in 12 fathems, until Conway Reef is passed, and then haul up to pass Cardon Island a mile off.

Conway Reef, lying 2\frac{3}{4} miles southeastward of Casta\tilde{n}on Bluffs, is the principal danger outside of Corinto in that direction. The two rocks above water, 8 and 5 feet high, are a little over \frac{3}{4} mile from the beach. The ground between the rocks and 1\frac{1}{4} miles seaward of them, and probably a greater distance, is very uneven. In passing the reef a berth of at least 2 miles should be given the rocks above water. Casta\tilde{n}on Bluffs, in range with the northern lighthouse, will carry clear of Conway Reef, but unless acquainted with the port it will be difficult to distinguish the bluffs from Cardon Island beyond them.

Coast.—From Corinto to San Juan del Sur the coast trends about southeast 107 miles, and consists generally of sandy beaches separated by cliffs against which the sea beats heavily. The 10-fathom line skirts the coast at a distance of from 1 to 2 miles, and 50 fathoms is found quite uniformly at from 15 to 17 miles. Anchorage along this coast is considered safe during the fine season, from November to May, when the winds are from the northeastward and at times

very strong. The district produces cedar and dyewoods and has been much reserted to by vessels to load that article of commerce.

At 11 miles from the Corinto lighthouse the flat sandy beach is broken by a low bluff rising directly from the water, and a little farther to the eastward and 4 miles inland is a range of hills 8 miles long, two of the peaks being, respectively, 890 and 920 feet high.

Nearly 18 miles from the lighthouse and $1\frac{1}{2}$ miles from shore is a $2\frac{1}{2}$ fathom shoal on which the sea breaks occasionally; close outside of it are 9 fathoms, but in other directions the water deepens gradually; at 1 mile 332° from it is another shoal patch with rocks under water.

Tamarinda River, which enters the sea in about latitude 12° 10′ N., is one of the principal places in Nicaragua whence cedar wood is shipped. The depot, consisting of a few huts, lies 6 or 7 miles within the entrance, and, it is reported, can be reached at high water springs by vessels drawing nearly 20 feet, but great caution is required, as the bottom is rocky and very irregular, and there are banks covered by only 2 feet water at low tide. Outside the entrance the depth is from 4 to 6 fathoms; here vessels may anchor, but only during fine weather, as it is extremely dangerous during the bad season.

Fronting the entrance are three sand banks nearly parallel to the coast and between these three groups of rocks. The two passages can only be recognized when very near them. The principal entrance is between the southern group and the coast; the depth in it is sufficient for a boat to pass without danger at low tide, if there is not too much swell, but a knowledge of the channel is necessary, and due precautions must be taken. The other entrance is between the northern and middle banks, the route is shorter, but the depth is very slight, and it can only be passed at high water, with a calm sea and perfect knowledge of the channel. Within the sand banks the sea is comparatively smooth. Whichever of these entrances is taken, it is necessary to pass between the banks and the coast to the northward in order to reach the river mouth; this is at first straight, but afterwards the river becomes tortuous. The flood tide ascends as far as the village, but beyond that the river is too shallow for boats.

There is good anchorage in 7 fathoms with Viejo Volcano bearing 339°, Memotombo 46°, and Cape Desolado 149°.

Tidal streams.—The ebb stream, especially after the rains, has frequently a velocity of 5 to 6 knots in the river, and then maintains 4 knots over the banks at the entrance. The speed of the flood stream does not exceed 2 to 3 knots.

Winds and weather.—From March 27 to May 12, 1887, the prevailing direction of the wind was east-northeasterly, especially in the morning and forenoon. Land and sea breezes were marked in this way, that the wind in the course of the day gradually veered from northeast through east to south, appearing about 4 p. m. as a sea breeze from southwest and toward evening, frequently after a period of calm, going back again to a land wind. The wind attained its greatest average force, 4 to 5 Beaufort scale, from east-northeast while the weakest was 1 to 3 from west. Calms occurred only in the evening. The gales (papagayos) occurred five times, when the wind reached force 8. In general the weather was fine and steady, only interrupted by occasional papagayos and short intervals of mist. The amount of cloud was but small, especially at evening.

A shoal with a depth of 2 fathoms lies about ½ mile offshore in latitude 12° 08′ 30″ N., and there is a rock awash close to this shoal, with deep water inshore of it. Surf is seldom noticed on this shoal, and that only at very low water with a very high swell.

The coast from Cape Desolado to Tamarinda appears to be very foul for a distance of 2 miles from it, as throughout the entire extent there is a strong surf. A vessel should only approach this part of the coast with the greatest caution, and keep at least 3 miles from it.

Coast.—From the Tamarinda River the coast trends south-south-easterly 11½ miles to Cape Desolado. The hills approach the coast and as the cape is neared they appear in places to rise precipitously. The water is deeper than to the northward, the 10-fathom line most of the way being but a mile offshore.

Cape Desolado, regarded as the northwestern limit of the papagayos, is a conspicuous headland, and owing to the low land just to the southeastward appears at a distance to project well into the sea, although in reality the change in the direction of the coast is very slight. The cliffs ending at the point are over 200 feet high, and just to the northward part of the ascent is faced with a smooth perpendicular rock, behind which the rise is gradual to the summit of the ridge.

The highest point, 460 feet high, ½ mile inland, when discovered from the northward, show several knolls on the seaward slope, and outside of these the headland soon rises. From the southward the face of the hill toward the interior appears to be steep, the other face descending gradually until near the shore, when it rises and then falls suddenly to the sea. When Loma de Tigre and the volcano Momotombo are in range bearing about 17°, Cape Desolado will lie almost in the range, but neither of these volcanoes can be seen when close under the land.

Venadillo Road, about 5 miles below Cape Desolado, in latitude 11° 55′ N., is an open roadstead affording anchorage in from 7 to 14 fathoms to vessels engaged in shipping cedar. During the winter months the anchorage is safe even when a papagayo is blowing, and although the wind frequently attains the force of a gale during the day, it falls light and sometimes calm at night. During the

summer months it is necessary to anchor farther out, in 10 to 14 fathoms, so as to be ready to weigh in case of the wind blowing on shore. Landing in boats is dangerous on account of the heavy breakers on the shore, and is feasible only in the morning. The cedar is brought off in rafts.

To facilitate the recognition of the locality, a mast has been erected on which a white flag with the word "Venadillo" is shown on the arrival of a vessel, but the mast is low and can not be distinguished beyond 1½ miles. The best guide is Mount Momotombo, which bears 11° from the road. No supplies nor even water are procurable.

People to get the cedar must be brought from Corinto and taken back there again.

Coast.—From Cape Desolado the coast trends 143° 16 miles, and then 129° 50 miles, to San Juan del Sur. From the point where the direction changes shoal ground with less than a fathom over it makes out 1,200 yards. The low land near the cape is succeeded by hills of moderate elevation, and these continue for some distance down the coast with no market feature about them.

At 37 miles below Cape Desolado a ledge with rocks showing above water lies a little more than a mile from the beach, directly under a group of mountains, the first met with near the coast after leaving the cape. The highest of these mountains is 2,060 feet high, but the peak nearest the coast, 1,465 feet high, is the most conspicuous; seen from above or below, when near the land, it shows a well-defined ridge, ½ mile long, at right angles with the coast, the inner end being the higher. The position of the shoal is fairly well indicated by the line of the ridge.

Gigante Point, about 53 miles southeastward of Cape Desolado and 6 miles northwestward of Brito, is a remarkable sand bank heaped up against one of the bluffs, and is concealed when approached from the northward by a projecting cliff, but in front or from the southward it can be seen for more than 12 miles; by moonlight, and when not in the shadow of the bluffs, it is very distinct. A prominent mountain, 1,555 feet high, rising 4 miles inland from the point, appears from the westward to be capped by a small circular eminence.

The coast in this vicinity is generally bold, some of the cliffs being almost precipitous, but at Brito the land is low, and the depression extends through the hills toward Lake Nicaragua.

Viejo Islet is a huge reddish-colored rock, 165 feet high, lying 9 miles above San Juan del Sur and 400 yards from the shore, with deep water around it.

Brito Harbor, 7 miles northwestward of San Juan, is merely a slight indentation of the coast at the mouth of the Rio Grande.

Brito Head, on the western side of the river entrance, is a bluff promontory, projecting a quarter of a mile southward of the general coast line; the land 600 yards behind the point reaches the height of 370 feet. A mangrove swamp extends over a mile southeastward from the mouth of the river, behind the beach. The depths in the road are regular, the 5-fathom line lying 350 yards from the beach, and the 10-fathom line \frac{1}{2} of a mile farther out, except off Brito Head, where there are 10 fathoms at 300 yards from the extremity. At 1 mile southward of the head the depth is 20 fathoms.

Port Nacascolo is little more than a recess in the cliffs, 1½ miles northwestward of the lighthouse at San Juan del Sur. A vessel anchoring just within the heads would be less than 200 yards from the rocks on either side, with shoal water less than 400 yards farther in.

San Juan del Sur is formed by an opening through the cliffs a little over ½ mile wide, backed by a curving sand beach, the bay within having an extreme breadth of ¾ mile and a depth of ½ mile. This limited space is still further contracted by the shallow water along the edge of the beach, while the entrance is narrowed to 800 yards by the rocky points under the cliffs. The opening of the cliffs to seaward, outside of the rocks, forms an outer bight about 600 yards deep. From the head of the bay the water deepens gradually to 5 and 6 fathoms between the rocky points and to 10 and 11 fathoms between the headlands. The bottom consists generally of sand and shells, but in some places is rocky.

The bluffs overlooking the entrance on the scutherly side are 433 feet high and the water is deep up to the edge of the reef. The same applies to that on the northern side, except that the reef extends out farther.

The low land behind the bay is succeeded by the foothills of the dividing ridge between the lake and the ccean, and $2\frac{1}{2}$ miles from the beach is Mount Papayal, 1,400 feet high. When within 15 miles of this mountain a stranger can not fail to distinguish it by the knolls or mounds along the ridge, the outline resembling that of the left hand closed, with the first knuckle uppermost and the palm turned away. The lighthouse and fort on the bluff at the south side of the entrance can easily be distinguished several miles. When near the port the Frailes Rocks can be seen to the southeastward.

San Juan del Sur Light, flashing white, visible 16 miles, is exhibited at a height of 100 feet on the southern side of the entrance to San Juan del Sur, from a white circular wooden tower, 15 feet high, with red lantern.

Cable buoys.—The cable buoys are a little to the northward of the lines shown on the chart, so that vessels anchoring southward of these lines will be well clear of the cables. There is a cable buoy moored about 275 yards, 357°, from the end of the wharf.

Caution.—Mariners are cautioned not to anchor northward of the buoys.

The village of San Juan del Sur stands on the eastern shore of the bay, plainly visible to a vessel approaching from the northward or westward. There is a small well-sheltered pier for boats and lighters on the southern side of the bay. The exports are coffee, sugar, hides, and cotton; the imports, manufactured goods; they are unimportant and not increasing. The village is 10 miles from Lake Nicaragua and about the same distance from the town of Rivas or Nicaragua, with which it is connected by a bad road. San Juan del Sur is reported to be healthy and the sanitary condition good. There is no health officer, though the cable company's doctor usually performs this duty.

The United States is represented by a consular agent.

Supplies.—Beef, bread, and poultry can be obtained, but no vegetables. No supply of coal or other steam fuel is kept by any firm at this port. Water is not obtainable.

Communications.—There is frequent steamer service by two lines. Four submarine telegraph cables are landed in this port, and the cable office serves as a relay point for ports north and south between Salina Cruz, Libertad, and Panama. There is a land line connecting with Rivas and other inland towns.

Tides.—It is high water at San Juan del Sur, at full and change, at 3h. 8m. The spring range is 10 feet.

The currents are not strong, vessels usually riding to the prevailing winds.

Directions.—There should be no trouble in finding the port in clear weather, nor in entering at any time if the headlands are made out. When well offshore the volcanoes of Mombache, Ometepe, and Madera, the peaks of Orosi, and the Cerros Elena will serve as landmarks; nearer, Mount Papayal will be distinguished, and the Frailes Rocks will be seen to the southeastward; the former, on a bearing 39°, opens the entrance. When the rocky points under the bluffs are made out, anchor or run past them into the bay.

The harbor being open to the southwestward the papagayos blow directly out, and as the squalls are often violent, the bottom shelving, and the holding ground poor, vessels obliged to go inside during the season of these winds should anchor so as to clear the rocks if they drag. When not loading it is better to lie outside, and preferably near the southern bluff.

Coast—Frailes Rocks.—From San Juan del Sur the coast trends 143°, 9 miles, to Cape Natan, and then 124°, 3½ miles, to Arranca

Barba Point at the entrance of Salinas Bay, and is everywhere high and bold, with soundings varying from 10 to 20 fathoms at $\frac{1}{2}$ mile from the beach.

Three miles from San Juan del Sur lighthouse and 800 yards offshore is West Fraile Rock, and 1 mile farther and $\frac{1}{4}$ mile from the shore is Middle Fraile. They are nearly circular, less than 200 yards in diameter, steep-sided, flat or oval topped, and 59 feet high. East Frailie lies $4\frac{1}{4}$ miles 152° from Middle Frailie, and 1,200 yards 264° from Cape Natan. It is a steep, jagged rock 88 feet high, and when seen from the northward looks like a sloop standing to the southward under all sail except gaff topsail. From the westward this islet, owing to the high rocks inshore of the same formation, can not be readily distinguished.

CHAPTER XI.

THE COAST OF COSTA RICA.

Costa Rica, with a population in 1913 of 410,981, extends on the Pacific Ocean from Salinas Bay to Burica Point. The soil is exceedingly productive and, owing to the different elevations, products of both the temperate and torrid zones are grown. The cool lands are from 5,000 to 6,000 feet above the sea, and from them several volcances rise to heights of from 8,000 to 11,000 feet. The forests, which extend over a large portion of the Republic, abound in timber suitable for shipbuilding, and in mahogany, brazil, and various other valuable dyewoods. The cultivated portion lies principally within the valley of the Rio Grande, and in this district are fully seveneighths of the inhabitants. San Jose, the capital, has about 25,000 inhabitants.

Costa Rica projects sharply into the sea at Cape Elena and then sweeps around to Cape Velas, this change in general direction from that of the Nicaragua coast above forming the Gulf of the Papagayos. The line of volcanic action, which presents so many distinctive landmarks in Nicaragua, is prolonged through Costa Rica, but owing to its divergence from the coast, only the mountains near the boundary are of value to the navigator.

Orosi Volcano.—Orosi Peak is 5,192 and Mount Gongora is 5,670 feet high. They are united by a lofty ridge about 3 miles long, which is often visible when the peaks are obscured. Orosi Peak is 34½ miles 163° from Ometepe Volcano in Nicaragua.

Rincon del Volcan Viejo, 8 miles 143° from Gongora, is occasionally active, and its sides are broken and deeply furrowed, differing in this respect from the other volcanic peaks of Nicaragua and Costa Rica.

Cerros Elena are a range of mountains forming the backbone of the Elena Peninsula, a remarkable headland reaching out into the Gulf of the Papagayos 15 miles, with an average width of 6 miles. Seen from the westward this headland looks like a mountainous island, but from the northward or southward it shows an oval serrated ridge, the outline resembling the edge of a half-open fan. Four of the peaks are over 2,000 feet in height. Cape Elena is the sharp and rocky termination of the headland. Salinas Bay.—This spacious harbor, formed by the doubling back of the coast, which sweeps around with a regular curve from Arranca Barba Point to Sacate Point. The bay between the entrance points is nearly 2½ miles wide and extends within them about 4 miles. The northern shore is high and bold, but the eastern and southern shores consist of sandy beaches and low marshy valleys, with bluffs at intervals. The peaks of Orosi, Gongora, and Rincon del Volcan Viejo overlook the hills behind the bay. Orosi Peak bears 107° through the entrance of the bay.

About a mile eastward of Sacate Point is Salinas Island, which is of triangular shape, about $\frac{1}{3}$ mile long and broad; the southern slope is much steeper than the northern, and as both appear, when entering the bay, to rise unbroken from the water's edge, the island resembles a wedge with the point to the northward.

The soundings decrease gradually from 20 fathoms just outside the entrance to 3 fathoms ½ mile from the head of the bay. Except just inside the southern headland, the northern and southern shores have shallows making out for nearly ½ mile, and while there are several ledges with rocks that uncover at low tide, none are outside of this distance. Close to the northwestern point of Salinas Island is a detached rock, and 400 yards from the eastern point there is another with foul ground 300 yards to the southward; a shoal covers the eastern and southern sides of the island to a distance of about ½ mile.

The trail from Costa Rica to Rivas and San Juan skirts the northern shore of the bay, and strikes into the hills 1½ miles eastward of Arranca Barba Point. There is a cattle ranch close to the northern shore and another a short distance from the head of the bay. A number of streams flowing from the hillsides have been found in December, but in the spring there were only dry beds.

Descarte Point, 2 miles 222° from Sacate Point, terminates the peninsula separating Salinas and Elena Bays. Nearly 1½ miles 292° from the point is a rock above the surface, but so small that it can not be seen at high water until close aboard; a number of dangers were found between it and the point.

Tides.—It is high water in Salinas Bay, full and change, at 2h. 43m. The rise is $7\frac{1}{2}$ feet.

Directions for Salinas Bay.—From the southward: Having passed Punta Blanca at a safe distance, keep Cape Elena showing outside of it, and when Salinas Island opens from Sacate Point, the rock off Descartes Point will be cleared, and the port may then be entered. If Orosi Peak is visible, bring it to bear 107° and stand in on that course. Having entered, pass to the northward of Salinas Island and nearer to it than to the northern shore of the bay, and then, if to get shelter from the westerly winds, stand on toward the head and anchor when the island bears north of west, but if a papa-

gayo is blowing, haul up and anchor as near the northern shore as the depth of water will permit.

Coming from the northward, the entrance of the port will be hidden by Cape Natan, the shore apparently continuing unbroken to the head of Elena Bay, but when the Fraile rocks are passed the port will come into view.

Elena Bay, which is entirely open to the westward, lies within Descarte Point and Punta Blanca, and is separated from Salinas Bay by a promonotory 4 miles long and 2 miles wide. A tongue of land divides the head into two small bays, the southern being known as Juanilla, and 5 miles westward of this bay is another called Port Elena. Except where broken by the entrance of Port Elena, the southern shore of Elena Bay for 10 miles presents a straight eastern and western line of high wooded bluffs or steep cliffs, terminating abruptly at Punta Blanca.

Near the northern shore of the bay, 1½ miles 157° from Descarte Point, is Despensa Island, with two elevations, of which the southern is the higher and the northern the more abrupt; and 2 miles 127° from Despensa is another island called Juanilla. Southeastward of the latter the depth is convenient for anchoring, but outside of it are soundings of 18 fathoms, deepening to 40 fathoms between the headlands. There is a reef between Despensa Island and Descarte Point, but otherwise the head of the bay is clear of danger.

Juanilla Bay.—The tongue of land already referred to which forms this bay is nearly a mile in length and about that distance from the southern shore, with which it is parallel. There are two small islands just off the end, and ½ mile farther westward is Vagares Reck, a low rocky islet. In the passage thus formed are two dangerous rocks with 1¾ and 2¾ fathoms over them, but the channel between the islet and the southern shore, a mile in width, is free from dangers, and therefore a vessel entering should approach from the westward and along the southern shore of Elena Bay. The water shoals gradually from 16 fathoms southward of the islet to the head of the bay. The bottom is mud and holds well, but a small indentation on the southern side, called San Tomas Bay, ¼ mile in extent, affords the only protection from a westerly wind and sea. About ¾ mile westward of San Tomas Bay is a small bight about ¼ mile in extent, with very shoal water.

Port Parker.—This fine landlocked harbor is 2 miles long and nearly a mile wide, and lies about midway between Juanilla Bay and Punta Blanca, in a narrow valley under the Cerros Elena and behind the cliffs which form the entrance. The entrance looks like a gorge, and, being the only break in the cliffs eastward of Punta Blanca, can easily be found. The loftiest summits of the Cerros Elena are farther

westward toward the cape, but the ridge behind the port is crowned by two conical peaks, readily distinguished. Just outside the heads are two small islands, Arriba on the east and Abajo on the west, but the latter is so near the cliffs that it can not always be distinguished when approaching from the northward. Tooth Rock, a small rock 300 yards westward of Arriba, will be made out as the entrance is neared, and must be left on the port hand going in. In the western angle of the bay a ledge makes out about 300 yards, and from the southern shore sand and mud flats extend a less distance.

Directions.—Approaching Elena Bay from the southward, keep 1½ miles from Punta Blanca to avoid the rock westward of it. To enter Port Parker keep ½ mile from the cliffs until the entrance and the island off it are recognized, then steer between Tooth Rock and the western shore, and anchor anywhere inside.

Tides.—It is high water in Port Parker, at full and change, at 2h. 30m. The rise is 5 feet.

Water.—The natives in the vicinity state that water can always be obtained.

Punta Blanca.—This bold and striking headland, sometimes called Elena Point, projects to the westward, its rocky sides rising abruptly from the water to the sharp and jagged summit, which, at about a mile within the point, is 681 feet high. The coast ridge which it terminates is separated from the Cerros Elena on the south by a narrow valley, which extends eastward to Juanilla Bay and includes Port Parker. Nearly 200 yards outside the point is a small rock 5 feet above water, and nearly a mile westward of this rock is another 2 fathoms under water, with 20 and 25 fathoms all about it. To avoid this danger, keep the Little Bat Island open from Cape Elena.

Playa Blanca Bay.—This bight, which is formed between Punta Blanca and Cape Elena, though open to the westward, affords a shelter from the papagayos, and, if it can be reached by a vessel overtaken by darkness when bound for San Juan del Sur or Salinas Bay, should be preferred to an anchorage under Cape Elena. About 3½ miles eastward of Cape Elena and a mile from the shore are two large rocks, and inshore of them is an island about 800 yards in extent. The mouth of the valley extending eastward from the head of the bay is fronted by a sandy beach ¾ mile long.

To anchor in the bay, steer in about 90° for the middle of the beach and let go in 8 or 10 fathoms.

Cape Elena.—Owing to its position and appearance this headland must be regarded as the most striking feature of the coast. It is a narrow rocky ridge, extending nearly 2 miles into the sea in a westerly direction, the sides rising abruptly from the water's edge and meeting sharply at the summit 449 feet high. A small islet and some

rocks above water lie close off the cape with soundings of 15 and 20 fathoms close-to and 40 fathoms at less than $\frac{1}{2}$ mile.

Murcielago Bay, southeastward of Cape Elena, and 3 miles westward of Potrero Grande Bay, is divided into two harbors by Bat Islands. San Jose, the largest of the Bat Islands, and the third in the chain from the eastward, is a little over a mile long and 479 feet high. Between the most westerly of the group and the Little Bat Island are dangerous ledges. Ackerman is the large island at the eastern end of the bay, and a little over a mile to the west-southwest, there is a low rock called Piedra Negra, with deep water close-to, which is almost connected with the island by a reef nearly half a mile long.

The bay is occasionally visited by small vessels engaged in the pearl fishery. There is a spring on Cocine, the island next east of San Jose. It is doubtful if water can be found there later than February, but there is a fresh-water pond 30 yards from the beach and half a mile north of the low point on the mainland connected with the eastern end of Ackerman by a reef.

Although vessels have anchored several times under the northeastern shore, between Rush and Ackerman, the two large islands above referred to, in from 12 to 15 fathoms, the bay is not safe during the season of the papagayos. On the lee side the islands have 30 fathoms or more close-to, and the declivity of the bottom along the northern slope is so sharp that the anchors do not hold well. The gusts that come down the sides of the mountain are often very heavy. As a rule, the papagayos moderate toward sunset, but this is not always the case.

Little Bat Island or Bat Rocks.—The larger of these rocks, 1½ miles 267° from the westernmost of the Bat Islands and 2¾ miles 217° from Cape Elena, is about 200 feet in extent and 70 feet in height, with flat top and perpendicular sides. From it the smaller rock, similar in appearance, but with a detached portion, the opening showing to the southwestward, bears 118°, distant 200 yards.

Caution.—The ledges to the eastward suggest the existence of pinnacles along the submerged ridge, which the lead failed to find; and, as the soundings give no warning of dangers, the average depth at ½ mile from the rocks being 50 fathoms, the passage between the rocks and the Bat Islands should never be attempted.

Directions.—To reach the anchorage from the northward, haul close around Cape Elena and steer 117°, keeping the Bat group on the starboard hand, and passing to the southward of Rush Island, separating the two bays, haul up a little and anchor under the lee of the land, with the western end of Ackerman bearing 180°.

From the southward, having made the group of islands under the cape, steer for San Jose on any bearing northward of 315° until

Ackerman Island bears 68° or Piedra Negra is sighted and brought to the eastward of this bearing, then steer in on 45°.

Potrero Grande Bay is 3 miles eastward of Murcielago Bay, the entrance, 1,750 yards wide, being open to the west-southwest between high hills; the bay widens a little within, but not enough to afford any additional protection to the anchorage. A sand beach curves around the head of the bay, and behind it is a lagoon which receives several rivulets from the surrounding hills, but as they are lost in the marshy ground along the border, while the outlet is obstructed by shallows, vessels should not attempt to water here. A number of rocks show above water close under the heads, but there are no dangers outside of them. Soundings decrease from 20 fathoms in the entrance to 5 fathoms at the head of the bay.

Coast.—From the southern extremity of the square-shaped promontory that forms the southeastern boundary of Potrero Grande Bay, the coast turns sharply northeastward for nearly 2 miles and then sweeps around to Gorda Point, forming a bay, 16 miles wide and 7 miles deep, within the great bay, 32 miles wide and 16 miles deep, between Cape Elena and Cape Velas. The northern shore is high and bold, but on the eastern side of the bay there is a wide valley extending inland, the southern slope rising to a table-land which fronts the bay, with cliffs 950 feet in height. Below these the shore, which turns to the southwestward, is moderately high and densely wooded. Soundings varying from 12 to 25 fathoms will be had within ½ mile of the shore, deepening to over 50 fathoms between the capes.

Blaze Rock, of quadrangular shape, 140 feet high, lies $\frac{1}{2}$ mile from the beach at the head of the bay, and near it on the southern side the depth is convenient for anchoring.

Huevo Bay is a small inlet, open to the southwestward, about 10 miles southward of Blaze Rock and immediately northward of Port Culebra, from which it is separated by a long narrow peninsula ending in Mala Point. The Huevos Islands, two in number, form the northern side of the bay, and lie so near each other, and the inner one so near the shore, that they appear to be high wooded bluffs on the mainland.

Port Culebra, the finest harbor in Central America, is spacious, secure, and easy of access, with water sufficient for the largest ships. The entrance, open to the southwestward and looking down the coast, is a mile wide between Mala Point on the northwest and Buena Point on the southeast, and extends within the points 4 miles to the northeastward, with an average width of 2 miles. The shores are steep-to, the water shoaling very gradually from 20 fathoms at the entrance to 5 fathoms near the head of the harbor, over a

bottom of mud and sand; anchorage may be had anywhere in the harbor.

Tides.—High water, full and change, at Port Culebra is at 3h. 15m.; the mean range of tide is 7.1 feet.

North Viradores are two flat, rocky islets just above the surface, with a rocky column 60 feet high, near the center of the outer and larger, which lies 600 yards southwestward of Mala Point. This column forms an excellent mark for vessels approaching from the northward; it will not readily be seen when coming from the westward, owing to the lack of vegetation on the steep face of Mala Point beyond. The other low rocky islet lies nearly 400 yards off Mala Point.

South Viradores are three small grass-covered islets off Cacique Point, the outer one being about $\frac{3}{4}$ of a mile from the shore. As these islets are fairly well defined against the wooded hills behind, they serve as marks for Port Culebra and Cocos Bay. Between the South Viradores and Cacique Point there is a channel of 5 to 10 fathoms, but it should not be used, as a rocky reef runs out $\frac{1}{4}$ mile to the westward of the point, and some detached rocks lie southward of the Viradores.

Directions.—Making Port Culebra from the northward, having rounded Cape Elena and the Little Bat Island, or Bat Rocks, steer 130° until North Viradores are made, then bring the pillar rock a little on the port bow and, passing it on the port hand, haul into the port.

Approaching from the westward or the southward, having made Santa Catalina Islands, 7½ miles northward of Cape Velas, pass it on the starboard hand, steer 51° past Brumel Island and Gorda Point, and then about 62° along the shore. South Viradores will soon be made out under the land, with the entrance beyond and a little to the left, and the anchorage will be reached with hardly a change of course. The distance from Cape Velas is 24 miles, and from Santa Catalina 16 miles.

Cocos Bay.—From Buena Point the coast sweeps around to Cacique Point, distant 1½ miles, and then in a deeper curve to Miga Point, 1½ miles beyond, the latter bight forming Cocos Bay. It is open to the northwestward, and extends a mile within the points, both of which are rocky cliffs surmounted by hills. The head of the bay is a sandy beach, from the southern part of which a line of rocks runs northward about ½ mile; another small rock lies in its eastern part. The depth of water shoals from 14 fathoms between the entrance points to 8 fathoms at 800 yards from the head.

If intending to anchor in Cocos Bay, bring the South Viradores to bear about 90° and run to within a mile of them, or until a long

low building at the head of the bight can be seen, then steer in, keeping a little nearer Cacique Point on account of the ledges near the southwestern shore, and anchor in 8 fathoms. The low building is the customhouse; Cocos Bay is the port of entry.

Coast.—From Miga Point to Gorda Point, about 4 miles 259°, the beach recedes under high hills, which at Gorda Point descend abruptly to the sea from a height of 340 feet. About 2½ miles southwestward of Gorda Point is another prominent projecting point, sometimes called Gorda, but less striking in appearance, though the change in the direction of the coast is greater; it is higher than the country in its vicinity, the highest point being near the sea, and appears as a great rounded hill with a slight indentation on the summit. From this point, off which lies Brumel Island, the coast sweeps around, broken by numerous bights, to Cape Velas, distant 10½ miles 202°.

Brumel Island, lying ½ mile southwestward of the point and extending ½ mile farther in the same direction, is 140 feet high, covered with grass and bare of trees. The shores are steep and rocky, and near the eastern end is a deep hollow which extends across the island, and viewed from the northwestward gives the appearance of two islands. Reefs extend from both the northern and southern sides to a distance of 600 yards and from the eastern end a short distance, but the extreme western end is clean, and no dangers were found in the channel between the island and the mainland.

Santa Catalina Islands, 3 miles 236° from Brumel Island and 7½ miles northward of Cape Velas, are an important landmark and not easily mistaken. They have been usually considered as one island, but the opening between them can be seen when bearing 45°. On every side a perpendicular wall of rock, over 100 feet high, rises directly from the sea, and as the sloping face above is covered with sacate, the resemblance to a stone fortification with tufted parapets is striking. The highest point of the island is 231 feet, and the depth close-to is nowhere less than 20 fathoms, while seaward it increases in less than a mile to 35 fathoms.

A bank extends 2½ miles to the southeastward of the islands, the water shoaling to 15 fathoms, and between it and the coast is a wide, 20 fathom channel. Scattered over this bank are several groups of pointed rocks that rise above the surface, and it is thought that there are others under water. Vessels should give these rocks a wide berth, not venturing within a line from Cape Velas to Santa Catalina Islands, except to run through the channel referred to.

Potrero and Braxilito Bays are open to the northwestward and lie in the angle of the coast between Brumel Island and Cape Velas, behind Santa Catalina Bank. They are simply curves in the shore, separated from each other by a high wooded point, nearly a mile in

length, and by Eyre Island, about 600 yards in extent, close to its extremity.

Ships loading on the coast with dyewood, cedar, and mahogany visit these bays occasionally. The only streams that were found do not probably long outlast the rainy season. While the outlying bank of Santa Catalina does not prevent the sea from rolling in, the waves are more or less broken by the rocks, and these bays may be regarded as tolerably secure anchorages.

Potrero, the northeastern bay, has several small islets on the northeastern shore, and near the head is a shoal patch with rocks awash; a small house, the only one in the vicinity, stands on the beach near the eastern angle of the bay, and a line through it from the middle of Eyre Island passes over this shoal. When going in, keep on the southwestern side and anchor where the depth is suitable, the water shoaling gradually from 15 fathems at the entrance.

Brexilito, the southwestern bay, has soundings which diminish regularly from 16 fathoms midway between the points of entrance to 6 and 8 fathoms ½ mile from the shore, but inside this distance they are irregular, and on either side at 800 yards from the shore are rocks under water or awash. If intending to anchor within ½ mile of the beach, do not allow Eyre Island to shut out the point of land nearest to Brumel Island, nor any of the groups of rocks on Santa Catalina Bank to close in with Santa Catalina Islands; by keeping between these ranges the dangers on either side of the bay will be avoided.

Directions.—The channels on either side of Santa Catalina Bank are wide and deep, and either may be used for entering Potrero and Braxilito Bays. A vessel using the northern channel should run in between Brumel and Santa Catalina Islands, and steer so as to pass to the eastward of a small black rock, 2 miles 110° from the northern end of Santa Catalina and showing but little above the surface at high water. When on the line between Brumel Island and Cape Velas (18°-198°) the rock will be passed, and, the point separating the two bays being a little on the starboard bow, the course can be maintained into Potrero Bay, or changed for Braxilito Bay.

From the southward, having rounded Cape Velas, keep about a mile from the shore, and when the southernmost group of rocks on Santa Catalina Bank is in range with the islands, Braxilito Bay will be open on the starboard bow. Steer for Eyre Island until all the groups of rocks are brought to the westward of Santa Catalina, and run into the bay between the ranges already given. For Potrcro Bay, stand on past Braxilito, round Eyre Island at a distance of about ½ mile, and, keeping nearer the southwestern shore, anchor in the desired depth.

Cape Velas is the southern limit of the papayagos, Cape Desolado, in Nicaragua, 110 miles distant, being considered the northern limit, though these gales are not strictly confined to these limits. The cape is well wooded, and off the coast to the southeastward of it are some islets and rocks.

Morro Hermoso, 769 feet high, rises immediately behind Cape Velas, marking this important turn of the coast, and looks like an island when first seen from the southward; it is often the first point recognized by vessels approaching the Gulf of the Papagayos when well over to the eastward. The sides have a regular and gradual slope, and the short narrow ridge running eastward and westward has a slight depression which gives it a saddle-shaped appearance, the eastern summit is round and the western sharp. Behind Morro Hermoso are several hills of greater elevation, and when approached from the westward the morro will first be noticed as a conical hill under them.

Southward of Cape Velas is a shallow bay in which vessels may anchor in a position midway between Wreck Point, at the southern limit, and a reef of rocks lying $1\frac{1}{2}$ miles below the cape and about $\frac{3}{4}$ mile from the shore. The boat landing is behind the rocks, and also close to a wreck on the beach at the head of the bight

San Francisco Point lies $6\frac{1}{2}$ miles 168° from Cape Velas and $3\frac{1}{2}$ miles below Wreck Point. From here the coast trends about 158° , 10 miles, and then 148° , 14 miles to Guionos Point. Detached black rocks will be met with in many places, but with the exception of the rocks and shoals in the vicinity of Guionos Point there are no dangers over $\frac{1}{2}$ mile from the shore.

Guionos Point shows from either side as a wooded hill with a gradual descent from the highest point, 360 feet high, to the edge of the cliffs that overhang the sea. A rocky reef, making out to the westward from the point, uncovers at low water, and at all times the sea breaks over the mass of rocks that have fallen from the cliffs. At a little distance below the point, the bluffs, with bare precipitous faces, are crowned by several wooded knolls.

There are a number of dangers to navigation off this point, made more serious by the great depth of water close to them, and by the northwestern current, which here runs in the winter at the rate of 2 knots an hour. A sunken rock, with 20 fathoms just inside of it and 50 fathoms within 2½ miles, lies 2½ miles 315° from the point and 2 miles from the shore. Another rock under water, with 15 fathoms close to it and 50 fathoms within 1½ miles, lies a little over a mile 162° from the point. In calm weather the sea breaks over these rocks only at long intervals. There are other dangers in the vicinity of the point, forming a continuous reef covering it from the north-

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west to the southwest, but none of them is outside of a line between the two just described.

Caution.—This point is difficult to recognize at night; allowance should be made for a probable set of current to the northwestward before rounding it from the westward. This current may prove to be of great velocity.

Coast.—From Guionos Point the coast trends 106°, 20½ miles to Quinones Point, and thence 141° the same distance to Cape Blanco, the western headland of the Gulf of Nicoya, forming an open bay 39 miles wide between the former point and the cape, and extending within them 7 miles. The land is said to be, in general, high and covered with trees, with occasionally some sandy plains and small deep bays. About 4½ miles eastward of Guionos Point a ledge makes out ½ mile from the shore; outside of this distance there appear to be no dangers along this entire stretch of coast.

Piedra Blanca Bay, about 11 miles eastward of Guionos Point and 29 miles from Cape Blanco, is semicircular in shape, nearly a mile in width and 1,400 yards in depth. From the western point a reef of rocks extends 135°, ½ mile, leaving an entrance of ½ mile open to the southeastward, between the end of the reef and the eastern point of the bay. A vessel entering should stand in along the eastern shore, which is clean, and should anchor sufficiently far to the westward to swing clear of a sunken rock which lies 600 yards 335° from the eastern entrance point. The water shoals gradually from 10 fathoms in the entrance to 3 fathoms at about 250 yards from the head of the bay. The best mark for the bay is Piedra Blanca, a large whitish rock, nearly 750 yards westward of the western entrance point and 200 yards from the shore.

About 1,200 yards westward of Piedra Blanca is a small islet near the shore, which will also be discernable against the cliffs as the entrance is neared. Within this islet and to the westward of it the shore recedes, forming a moderately deep bay, but rocky and unsafe.

Quinones Point, midway between Guionos Point and Cape Blanco, projects but slightly into the sea to the westward, the extremity being sharp and rocky.

Musimillama Point, 5 miles 134° from Quinones Point, is similar to the latter, but more projecting. From here to Cape Blanco the coast trends 134°, 15½ miles, and is a wooded country through which several small streams discharge into the sea.

Coast marks.—Between Cape Velas and the Gulf of Nicoya, the mountains are of moderate elevation, and to a vessel in the offing they present few peculiarities of outline; but on a nearer approach the Cerros de San Blas will be made out northward of Guionos Point, or Split Peak northward of Cape Blanco.

Cerros de San Blas, a short mountainous ridge parallel with the coast and 8 miles distant from it, can easily be made out, as it is so much higher than the land to the westward, the highest point, 3,337 feet high, bearing southeastward from Cape Velas, distant 19½ miles. The cone-shaped summit of Mount Boughey, 2,558 feet high, will be seen about 8 miles northeastward of Guionos Point, and between this mountain and Split Peak the coast range shows several points of equal elevation, with no particular marks for distinguishing them.

Split Peak, 2,592 feet high, 154 miles northward of Cape Blanco and 7 miles from the coast near Musimillama Point, takes its name from the cleft, distinctly visible from the westward, that divides the summit of the mountain, the southern point being the higher. It rises from the plateau northward of Cape Blanco, and as it exceeds in altitude any of the peaks between it and the Gulf of Nicoya, it may be regarded as the eastern termination of the coast range.

Cape Blanco is the termination of a plateau that forms one of the most striking landmarks on the coast, especially when approaching from the westward. The plateau is 1,200 feet above the sea and extends inland 6 miles, forming a promontory between the sea and the Gulf of Nicoya. Inland and northward of it a lower plain succeeds, stretching to the foothills under Split Peak, and while this plain remains below the horizon the more elevated plain resembles a long level island some distance from the mainland. Every other headland on the coast is irregular in outline, and Cano Island, off San Pedro Point, which alone can be said to resemble it is so near the coast to the eastward that a mistake would be impossible. From the brow of the cliffs at the southern end of the plateau the distance to the extreme point of the cape is little more than a mile.

Blanca Island, 1 mile southward of the cape, is 193 feet high and oval in shape, with an extent of 600 yards from north to south; it is a mass of whitish rock rising abruptly on all sides, with a small patch of scanty vegetation at the highest point. The islet is surrounded by a racky ledge, which dries at low water, with 10 to 30 fathoms immediately southward of it. The channel between the islet and the shore is not recommended for use.

Gulf of Nicoya.—This great gulf, one of the most important places of resort on the west coast of Central America, is 35 miles wide at the entrance between Cape Blanco and Judas Point, and penetrates into the land about 52 miles, at first in a northerly and then in a northwesterly direction, narrowing to 5½ miles at 26 miles from the entrance, and then expanding with an average width of 8 miles to the head. The only port of entry is Punta Arenas, on the eastern shore about halfway up the gulf and at its narrowest part. A number of islands lie along the western shore, some of them of con-

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siderable extent, and vessels navigating the gulf pass to the eastward of all of them.

Jasper Island, 563 feet high, is 13 miles within the line of the headlands and 18½ miles from Blanca Island. Alcatraz Island, separated but little from Jasper, lies between it and the western shore.

Detached rocks, with 18 fathoms close outside them, extend 4 mile from the eastern point of Jaspar Island.

The Negritas Islands, 3 miles northeastward of Jasper, are separated from each other and from the mainland by openings so narrow that these ilsands form in effect a narrow, rocky point, projecting from the shore $2\frac{1}{2}$ miles to the eastward; a rocky ledge extends from the eastern end nearly $\frac{1}{2}$ mile farther to the eastward, and has near its extremity a large rock known as Sail Rock.

Sail Rock is 24 miles, 48° from Cape Blanco, 14¾ miles, 323° from Cano Island, and 9¼ miles, 176° from Punta Arenas Pier. With light or variable winds sailing vessels should avoid getting too near this rock, as the tide runs past it with considerable force and the depth is too great for anchoring.

Cedro Island, about 1½ miles northwestward of the Negritas, is of considerable size, but very irregular shape, and its southwestern end is in close proximity to the shore. There are several small islets about it, and others in the bight to the northward.

Aves and Pan de Azucar are small but conspicuous islets, distant, respectively, 6 and 7½ miles northwestward from Sail Rock. The latter islet is sometimes resorted to for shingle ballast, the anchorage being on the west side.

Two sunken rocks lie 112° from Pan de Azucar at a distance of 400 and 1,200 yards, respectively. Foul ground extends half a mile 61° from Aves Island.

San Lucas Island, opposite Punta Arenas and at the turn of the gulf, is nearly 2 miles in extent and has a small but secure harbor on the northwestern side. The island is a Costa Rican convict station and communication with it is forbidden.

Caballo Island is about $3\frac{1}{2}$ miles above San Lucas and $2\frac{1}{2}$ miles from the western shore; just beyond it is Bejuco, and 1 mile from the latter Venado Island, in close proximity to the shore.

Chira Island, near the head of the gulf, greatly exceeds any of the other islands in extent, being 6½ miles long, east and west, and 3 miles wide. Extensive shoals border the island, except on the northeastern side, where there are 4 and 5 fathoms near the shore, with good anchorage.

Tempisque River, a sluggish muddy stream, discharges into the gulf at the head, 6 miles above Chira Island. A small steamer from

Punta Arenas navigates the river as regularly as the tides permit, advantage being taken of high water both for crossing the mud flats below the mouth and for ascending and descending the river.

Nearly all the woods shipped from the gulf are cut on the banks of the Tempisque River and its tributaries and floated down to Chira, where vessels load.

The western shore of the gulf borders an uncultivated and almost uninhabited region, and is seldom visited. Between Cape Blanco and the Negritas the soundings increase rapidly offshore, but at about 3 miles above the cape a rocky reef makes out about a mile and extends some distance along the shore. Above the Negritas and as far as Venado Island, the depth is convenient for anchoring, but above the latter island extensive shallows occupy the western two-thirds of the gulf all the way to the head.

Ballena Bay.—Having rounded Cape Blanco and brought the western shore and Jasper Island into view, Ballena Head, a bold conspicuous promontory 14 miles above the cape, will be made out, and on nearing it, Ballena Bay, which indents the land 2½ miles with a width of 2 miles, will open out between the head and several wooded hills to the southward. A low sand beach, broken by several entrances to the estero behind it, sweeps around the head of the bay, and scattered along it just above high-water mark are a few native huts. The water shoals rapidly from 24 fathoms between the headlands to 3 and 4 fathoms 600 yards from the head of the bay. Running in, it is only necessary to keep ½ mile from either point, as none of the outlying rocks is more than ½ mile from shore.

Tides.—High water, full and change, in Ballena Bay is at 2h. 26m.; rise of tide 11 feet.

The eastern shore of the gulf, from Judas Point, the eastern entrance point, trends northwestward 11½ miles in nearly a straight line to Herradura Point, and thence sweeps around in the great bight of a flattened semicircle to Arenas Point, which bears 333° from Herradura, the depth of the bight between these two points being nearly 6½ miles. At the head of the bight, in the vicinity of the Rio Grande, the 5-fathom line runs about 1½ miles from shore and the 20-fathom line close outside; but the water is in general deep along this shore as far as Calderas Bluff, above which the depths are convenient for anchoring. Off Caño Island and Herradura Point there are 30 fathoms of water within a mile of the land.

Judas Point, the eastern headland of the gulf, is marked in front by only the breakers on the reef, but from either side when near the land, Mount Judas, a wooded eminence 321 feet high, will be made out above it, having a steep ascent at first and then rising gradually to the highest point, ‡ mile inland.

Judas Reef makes out from the point 1½ miles in a southwesterly direction, shelving slightly and partly uncovering with the tide, the sea at all times breaking over detached rocks that show here and there above the surface. Vessels in passing should keep at least 2 miles from the shore, and at that distance, when just off the reef, will have soundings in 10 and 12 fathoms. The existence and direction of a submarine ridge are indicated by this reef, less than 40 fathoms having been obtained at 15 miles 219° from the point, the average depth at that distance from the coast hereabout being nearly 200 fathoms.

Escollo Rock, on which the sea breaks occasionally, lies a little over 7 miles northwestward of Judas Point and 3 mile off Guapinol Point, between which and the rocks are 10 fathoms of water; outside the rock the depth increases quickly to 20 fathoms, the lead giving no indication of its proximity.

Caño Island, 10 miles northwestward of Judas Point, is connected at its eastern end with the mainland by a reef, bare at low water, and consists of a narrow, rocky ridge, its line of direction perpendicular to that of the shore, the sides rising abruptly and terminating at the crest. It is a prominent mark for vessels coming up the coast, appearing as a bold and lofty headland to the left of the Herradura Mountains.

Port Herradura, between Caño Island and Herradura Point, is an indentation about 1½ miles in depth and width, open to the westward but affording shelter from all other quarters. It is rarely visited, however, communication with the interior being virtually cut off by the mountains that hem it in, while its advantages as an anchorage and port of refuge at the entrance of the gulf are impaired by the sunken Havannah Rock nearly in the center. Along the northern shore of the bay are numerous detached rocks, nearly 400 yards off, and a ledge extends ¼ mile 202° from Herradura Point. The water is deep between the heads, and the soundings are irregular for some distance within, but near the beach extending across the head of the bay, and a little below the mouth of a small stream that affords an abundant supply of fresh water, the anchorage is good in about 8 fathoms.

Anchorage.—The anchorage is good in the northeastern part of the bay, in about 8 fathoms, half a mile from the beach at the head and 700 yards from the northern shore.

Havannah Rock has a depth over it of only 2 feet at low-water springs, and is sometimes visible when there is a swell. It seldom breaks even at low water, and vessels running in under ordinary conditions of wind and weather should therefore depend upon bearings

to avoid it, not allowing the western end of Caño Island to draw to the westward of 211° until Herradura Point bears 295°, when the danger will be past. It has been reported that Havannah Rock breaks only at low water of equinoctial springs.

Tides.—The lunitidal interval is 2h. 35m.; spring rise, 9 feet; neap, 4.9 feet.

Sucia Point, 2½ miles northward of Herradura Point, is fronted by a rocky ledge which projects 1 mile to the westward and partly shows at low water; close to the outer edge of this reef the depth is 19 to 25 fathoms. Mantes village, on the shores of a little cove above Sucia Point, contains about 30 houses and may be known by two detached light-colored rocks to the northward. Outside of the beach in front of the village is a ledge that uncovers at low tide, and beyond this the water soon deepens to 20 and 25 fathoms. The natives land at high water, and haul their boats into the basin at the mouth of the creek south of the village and just within Agujas Point.

Tarcoles Bay, 4 miles northeastward of Sucia Point, is said to afford good anchorage and easy communication with the shore, but information is wanting concerning this anchorage, and the chart supplies no details.

Tivives.—The village of Tivives lies just within a bluff point 10 miles northward of Sucia Point and 2½ miles southeastward of Calderas Bluff. The chart indicates a small islet and two sunken rocks about ½ mile northwestward of Tivives Point.

Calderas Bluff.—From Sucia Point the coast trends about 40° 5 miles, and then northwestward 10 miles to Calderas Bluff, which is high, steep, and covered with trees. In the northern portion of the bight and within 1 or 2 miles of the shore the depth is not too great for anchoring. About 4 miles north of Calderas Bluff, at the mouth of the Barranca River, the coast turns westward for 7 miles to Arenas Point.

Calderas, on the northern side of the bluff, was the port of entry for Costa Rica until 1840, at which time its unhealthiness caused it to be abandoned for Punta Arenas.

Punta Arenas is the only port of entry in the Gulf of Nicoya and the only place of importance on the Pacific coast of Costa Rica. The town is situated about ½ mile from the end of a slender tongue of land which extends to the westward from the mainland nearly 4 miles along the southern side of an inlet or estero opening to the westward. A shoal bank, with depths as little as 2 fathoms in patches over it, extends 3 miles about 157° from the outer end of the peninsula, and the roadstead is on the eastern side of this bank, the channel leading up the gulf being on the western side. Though open

to the entrance of the gulf, some protection is afforded to the anchorage by the Negritas Islands, jutting out from the eastern shore of the gulf, 8 miles to the southward.

The inner harbor, the estero behind the town, is landlocked and perfectly secure, but as the depth on the bar is only 1½ fathoms a pilot must be taken if intending to enter. There are no docks, but small vessels may be hauled up at high water on the beach in the estero. A pier has been authorized by the national legislature.

No vessel is allowed to enter a Costa Rican port until visited by a health officer, the captain of the port, and a customs official.

The town is regularly laid out and had a population of about 4,710 in 1911. An iron pier, 425 feet long, 30 feet wide, has a house at the outer end. It is provided with two donkey engines, and a double-track railway leading to the customhouse and to the various storehouses in the town facilitates the discharging by lighters of vessels in the roadstead. Landing at the pier is always feasible, but there is sometimes a nasty wash off it, especially at low tide. A well-traveled highway leads to San Jose, the capital, which is connected by rail with Port Limon on the Atlantic coast. A railroad extends to the village of Esparta, some 8 miles eastward of Punta Arenas, and from Orotina to San Jose.

Light.—An unwatched flashing light, visible 9 miles, is exhibited at an elevation of about 55 feet from a tower erected on the top of the shed at the end of the pier.

Anchorage.—The anchorage usually selected during the fine season, from November to June, is in 5 fathoms with the pier bearing about 292° and Pan de Azucar 242°, but the depth is convenient for anchoring as far eastward as Calderas Bluff or the Barranca River, the water shoaling gradually to 3 and 4 fathoms at ½ mile from the beach. In winter it is necessary to anchor farther out on account of the inconvenience caused by the heavy rollers sent in from the southwestward. It is advisable to moor southeast and northwest as the holding ground is said not to be good, and anchors are liable to be fouled by the ship's swinging to the tidal streams and to land and sea breezes.

Buoy.—A green cylindrical buoy has been established in a position 264° (approximately) from the pierhead, distant about 1,000 yards.

Tides.—High water, full and change, is at 3h. 10m.; springs rise about 10¾ feet, ordinary tides 8½ feet. The tides are regular.

Tidal streams.—The flood stream sets north-northwest and the ebb stream south-southeast, with a strength of 1 to 1½ miles an hour. At a position one mile eastward of the pierhead the flood stream was observed to run westward and the ebb eastward, both streams attaining a velocity of about 2 knots.

Supplies.—Cattle, poultry, bread, and vegetables, including good native potatoes, are procurable. Water can be procured. It is pumped by hand from shallow wells and is brackish. To obtain water from Barranca River is reported as impracticable. Coal is not procurable.

Communications.—There is frequent steamer service by several lines. A small steamer makes regular trips to the villages on the Tempisque River.

Mails for the United States and Europe by way of Port Limon leave every week, for San Francisco three times a month, and for Panama and the southward at frequent intervals. Mails arriving are first sent to the capital, and then returned for distribution.

There is telegraphic communication with San Juan del Sur, the nearest cable station, and with the several towns in the State.

Trade.—The principal export is coffee, but there is also some trade in hides, cedar, mahogany, and dyewoods. The imports are manufactured goods of various kinds. Tobacco, gunpowder, and saltpeter are admitted only on Government account, and rum and firearms only by special permission.

Winds and weather.—There are only two seasons, the rainy and the dry, the former generally lasting from April 15 to November 15. During the summer the winds blow from south-southwest from 10 a. m. to 6 p. m., then, after an interval of calm, spring up from north-northeast. In September and October strong gales sometimes blow from southwest to west, with heavy rain. During the fine season the weather is very dry, with clear sky and horizon; sometimes, but rarely, a little rain falls in March. From January to March there are sometimes strong breezes from the northward, with violent squalls, the sky and horizon remaining very clear.

During the winter season calms prevail, but often in the evening violent "chubascos" blow from east to northeast, with heavy rain, lightning, and thunder; the "chubasco" lasts from half an hour to an hour.

Health.—Punta Arenas seems to be unhealthful. In the estero the refuse of the town collects on the mud flats and must have an unhealthful influence. Intermittent fevers are frequent, and sometimes there are cases of yellow fever. There is said to be a small hospital to which all are admitted free.

Directions.—The entrance to the Gulf of Nicoya is so wide that no difficulty whatever should be experienced in making it, being plainly marked on the western side by Blanco Island and the plateau behind Cape Blanco, and on the eastern side by the termination of the mountain range that overlooks the coast below, the last spur, known as the Herradura Mountains, rising abruptly from the eastern shore of the gulf to a height of 2,813 feet. Cerro Grande de Turubales, 17

miles 13° from Judas Point and 5,838 feet high, shows over the Herradura Mountains when off the entrance of them when down the coast, and is a prominent peak with a small conical summit; 2½ miles eastward of it is a mountain 5,335 feet high, with a flat top nearly ½ mile across; 20 miles farther eastward are mountains of still greater elevation, one of them, 7,938 feet high, showing at its summit the broad crater of an extinct volcano.

Approaching from seaward it is usual to steer for Cape Blanco, keeping a little eastward of its meridian, and afterwards to direct the course into the gulf; but it appears probable that some advantage would be gained if the land about Port Herradura were made instead of the cape, as the effect of the westerly current would thereby be to some extent neutralized; a mile or two would also be saved in the subsequent route to Punta Arenas.

Having entered the gulf, keep along the eastern shore, as it is shallower than the opposite coast, and also because the effects of the ebb stream, which, southward of the Negritas Islands, flows southwestward, will not be so strongly felt. The soundings, although great, are not so deep but that the anchor can be let go in the event of a calm and a contrary current. The flood has occasionally considerable strength and requires to be guarded against, as its tendency is toward the Negritas Islands, in the vicinity of which the water is very deep; off the southern side of the Sail Rock the depth is 24 fathoms, deepening rapidly seaward to 36 fathoms. The course hence to Punta Arenas is direct, and by keeping the light bearing to the westward of 338° vessels will be clear of all dangers until the anchorage is reached. Both ebb and flood set strongly over the Punta Arenas Bank.

From the northward, in a steamer, having rounded Blanco Island, off Cape Blanco, at a distance of 1 mile, if bound into Punta Arenas, steer for Sail Rock. If at night, pick up Jasper Island, which is higher than the Negritas, and if very dark be sure to give Sail Rock a berth, as it is not very high and can not be seen far. If the light is made after passing Sail Rock, bring it to bear 338°, run for it and anchor in 5 fathoms, sandy bottom. If, however, the light is not made, run over and make Calderas Bluff, and then coast along in 6 fathoms until off the village, anchoring in 5 fathoms.

By running close to Calderas Bluff and then coasting, the shoals will be avoided, and if there are vessels at the anchorage they will show clear of the point. These hints are intended only for night, as by day there is not the slightest difficulty in making this port, merely running for the end of the pier on a bearing to the westward of 338°.

In making the port from the eastward, pass 2 miles from the Cano Island off San Pedro Point, and steer about 320° for Cano

Island at entrance of Port Herradura, which will be seen by day at a distance of 30 miles, if the weather is clear, lying off a high mountain, with a slight break or gap between them; at the same time Judas Point, a low point under the mountain, will be seen to the right. About this time Quepos Point will be abeam, distant about 15 miles, looking like a saddle and easily recognized, and affording a fresh departure. High land a little on the port bow, and perhaps Cape Blanco broad off the port bow, will also be visible. If a dark night, do not try to makes Judas Point, but keep on until Guapinol Point is seen; this is a bold high bluff, and readily known. Cano Island is the best mark for the anchorage; it is bold and can not be mistaken; when abeam it resembles a haystack. After this comes Herradura Point, and then Sucia Point.

Having passed Cano Island about 2½ miles distant, and brought Herradura Point abeam, steer 344° until the light is seen, which will be at a mean distance of 6 miles, or, if not seen, run for Calderas Bluff and proceed as before.

When coasting along from Calderas Bluff in 5 or 6 fathoms of water and no lights are seen, be careful not to pass the town, as there is danger of running on the shoal. In the dry season there will be many fires on the land; care must be taken not to mistake them for the light.

When in doubt, anchor and await daylight.

The flood tide sets northeastward and north from Cape Blanco, then northwestward and at the anchorage west; the ebb runs in a contrary direction. It is said that off Herradura Point the flood sets over to the westward, probably northwestward, while on the western shore it sets in to the land. Strong tide-rips will be found off Sail Rock. Always calculate the time of high water at Punta Arenas when bound there, so as to know the set in going up the gulf.

Chira Island anchorage.—If bound to the anchorage at Chira Island, with Sail Rock bearing about 270°, distant ½ mile, steer 334°, to pass Aves and San Lucas Islets at a distance of 1 mile; when the northeastern point of the latter islet is abeam change course to 315°, and when the Duck Islands off Duck Point are abeam, ½ mile distant, change to 294°, anchor in 5½ fathoms, ½ mile from the northeastern shore of Chira. The run is about 9 miles on each course. In passing Aves Islet a vessel should keep outside of 10 fathoms to avoid the small shoal at its eastern end. There is water for any draft as far as the Duck Islands; thence to the anchorage, a least depth of 4 fathoms.

Coast marks between the Gulfs of Nicoya and Dulce.— Llorena Point lies 73 miles 139° from Judas Point, and between them the coast curves to the eastward in a great bight, which at Uvita Point, 32 miles northward of Llorena, reaches a depth of 21 miles within the points first named. From Llorena Point the general trend is 117° for 29 miles to Matapalo head at the entrance of the Gulf of Dulce.

Mount Herradura and Mount Turubales, with its small conical summit, near the entrance to the Gulf of Nicoya, have been described. About 20 miles 110° from Turubales and 14 miles from the coast is an extinct volcano 7,938 feet high, the crater of which, nearly 2 miles across, has a number of regular elevations along the brink, giving the summit the appearance of a lofty serrated ridge. Four miles southward of the volcano is a dome-shaped mountain 7,115 feet high. Still farther eastward the range presents some of the loftiest summits in Central America, Mount Walker, 24 miles northeastward of Uvita Point, rising to a height of 12,413 feet; but these summits are partially concealed by the cost range behind Uvita, and are not easily distinguished. This is of little consequence to the navigator, however, as the bight of the coast between Judas and San Pedro Points could not be entered in clear weather without sighting Turubales and the other mountains to the northward, or Cano Island, off the latter point, and the Cerros de Sierpe to the eastward. Making the land below the bight, vessels will have Cano Island or the headland of Llorena Point in sight above or the Gulf of Dulce and Burica Point below.

Coast.—From Judas Point the coast trends about 101° for nearly 23 miles to the Viejo River, and then about 191° for 2 miles to Quepos Point. The land immediately behind the beach is low, and the ascent toward the mountains in the interior, for the first few miles, is gradual. Vessels may anchor anywhere, as there are no dangers over ½ mile from the shore and the soundings increase regularly.

Quepos Point is a bold and prominent point at the western end of a line of densely wooded bluffs, nearly 500 feet high, that rise abruptly from the shore to the eastward. Near the point and to the northward of it are a number of outlying rocks.

Naranjo Point lies 3½ miles 118° from Quepos Point. The bluffs terminate here, and the coast recedes to the northward 1 mile, to the mouth of the Naranjo River.

Quepos Islands, with the exception of one wooded island east of Naranjo Point, consist of a chain of bare rocky islets and detached rocks, the westernmost lying 1,600 yards 157° from Quepos Point, openings toward the outer end, projects 2½ miles from the island, the direction being indicated by the Barrel Rock, a black cylindrical rock 21 feet high. 1½ miles 278° from the island. The small rock above water, before mentioned, lies northwestward from the end of

the reef, at a distance og $1\frac{3}{4}$ miles; and the rock awash at a mile in nearly the same direction.

Coast.—From Naranjo Point the coast trends about 124° for nearly 25 miles to Uvita Point. At first, hills of moderate elevation and long rounded ridges parallel with the shore are met with, but farther on the spurs of the Cerros Uvita rise abruptly from the sea. Dominical Point, 6½ miles northwestward of Uvita, projects slightly and is not very noticeable, but may be distinguished by its dark color. A reef extends southeastward from this point for over a mile, but is close to the shore. About midway between Dominical and Uvita Points and 1¾ miles offshore is a rock above water, and ¾ mile southward of this rock and 24 miles offshore is a rock awash.

Uvita Bay.—Nearly 400 yards southwestward of Uvita Point, and connected with it by a sand spit that uncovers at half tide, is a small circular island, also called Uvita, from which two rocky reefs make out, one in a westerly and the other in a southeasterly direction, the whole resembling in form the letter Y.

Behind the hook formed by the point, the sand spit, and the southeastern arm of the reef is Uvita Bay, which, as the coast a few miles below sweeps around to the southward, affords a tolerably secure anchorage during all winds. The reef is a little over $\frac{3}{4}$ mile long, and the end, which is fairly well marked by the rocks that show above water, can be safely rounded at a distance of 400 yards. Round rock, a few feet high, which marks the opposite side of the passage leading into the bay, lies $1\frac{1}{2}$ miles 152° from the end of the reef, with deep water close-to.

On Uvita Island are two or three huts that can be distinguished several miles, and as there are no others near the shores of the bay they serve to mark the anchorage and the position of the reefs.

From Uvita Point the sand beach, with a strip of lowland between it and the mountains, curves around 2 miles to the southeastward and then ends against a bluff. Fresh water can be obtained from two small streams that enter the bay near the anchorage; the one farther from the point flows from a pool 10 to 12 feet deep, where casks can easily be filled and rolled across the beach.

The bay westward of Uvita Point, formed by the sand spit and the arm of the reef making out to the westward from Uvita Island, has a number of sunken rocks off the entrance and is exposed to a westerly wind and sea. The reef, through which are several openings toward the outer end, projects $2\frac{1}{3}$ miles from the island, the direction being indicated by the Barrel Rock, a black cylindrical rock 21 feet high, $1\frac{1}{3}$ miles 278° from the island. The small rock above water, before mentioned, lies northwestward from the end of the reef, at a distance of $1\frac{3}{4}$ miles; and the rock awash at 1 mile in nearly the same direction.

Ballena Island, which lies a little over 1 mile from the coast and nearly 1 mile 112° from Round Rock, with which it is connected by a reef on which the sea often breaks, is the mark for finding Uvita Harbor. It is a mass of whitish rock, 400 yards long and 116 feet high, and shows distinctly against the wooded slope of the mountain behind it, being often mistaken at a distance for a cliff or hillside left bare by a land slip. Coming from the southward or southwestward, the island shows three points of equal elevation, but from the westward only two. The Ballenitas are three pointed rocks, 59 feet high, 1 mile eastward of Ballena and about ½ mile from shore. There are many sunken rocks in this vicinity, and the anchorage at Uvita is therefore not accessible except by the channel already described.

Tides.—Lunitidal interval is 2h. 20m. in Uvita Bay; tide rises 9.5 at spring; 5.1 neaps.

Directions.—Coming from the northward and intending to enter Uvita Bay steer for Ballena Island on the bearing 112° until Uvita Island bears 6°, then haul up to 62°, the reef on the northern side of the entrance, or Round Rock on the southern side in range with Ballena Island, being in sight. When on the line between Uvita and Ballena Islands, being just past the end of the reef, haul up to 349° and anchor in 6½ fathoms, sandy bottom, with the houses on Uvita Island bearing 287°.

From the southward, steer for Ballena Island until Round Rock is sighted, and then steer to round the rock at a distance of ½ mile. Having passed the line between Round Rock and Uvita Island, which is also the line of the northern reef, steer 354° for the anchorage given above.

In approaching the entrance, Barrel Rock to the northward, the Ballenitas to the southward, and the bluff at the end of the sand beach within the bay may be of use as marks.

The passage between the end of the reef and Round Rock, 13 miles wide, shows very irregular soundings over a rocky bottom, a 9-fathom spot occurring nearly in mid-channel, with 11 fathoms toward the reef and 21 fathoms toward Round Rock. Just outside the entrance are 17 to 19 fathoms, and within the water shoals gradually and regularly to 4 fathoms, at 1 mile from the head of the bay.

Mala Point, 6 miles southeastward from Uvita Point and 3 miles from Ballena Island, lies under the mountains and is bold with cliffs.

Coast.—From Mala Point the coast turns to the eastward for a mile and then sharply southward for 15 miles to Guajamal Bay, where it again turns sharply to the westward to Violin Point. The Cerros Uvita range preserves its southeasterly direction, and the coast curving away from it skirts a low plain covered with a growth of mangroves and traversed by several sluggish rivers. Southward

of this plain the Cerros Sierpe rise to a height of 2,255 feet. The depression between the two ranges extends across to the head of the Gulf of Dulce, but the narrowest part of the neck of the peninsula, 9\frac{3}{4} miles wide, is a little farther south where the mountain ridge intervenes.

Sacate Islands, 3 miles northward of Violin Point and 2 miles from shore, are two flat rocks, 30 feet high, so close together that they generally appear as one. It would be prudent to keep a mile to the westward of a line between them and the Violin Islands.

Guajamal Bay, above Violin Point, is shoal, and the low coast northward of it must be approached with caution, especially off the river mouths, as the soundings diminish suddenly inside of 15 fathoms.

Violin Point, which is steep and rugged, has several small wooded islands, known as the Violin Islands, so close under it that they can be made out clearly only when approached along the coast. The Sierpe River enters the sea southward of Violin Point.

Coast.—From Violin Point the coast trends southward for 5½ miles to the mouth of the Aguja River, and then bends sharply to the westward for 3½ miles to San Jose Point. In the bight thus formed the anchorage is good, and vessels can send their boats for water up the Aguja River. San Jose Point is a bluff headland with deep water at a moderate distance from the rocks at its base. It may be recognized by a large green patch, bare of trees. San Pedro, the next point, 3 miles 207° from San Jose, is a cliff having rocks about it under water. Between these points the shore recedes a little, and midway between them, nearly a mile offshore, is Lowrock Reef.

The coast from San Pedro to Llorena Point, 3 miles to the southward, curves seaward, and is bordered by a rocky reef along which a number of islets rise, the largest of which is San Pedro Rock, 217 feet high. At the upper end of the reef only low black rocks are visible, but near Llorena Point the islets are high and wooded, like the bluffs from which they have evidently been detached. The face of the reef is comparatively clean, and vessels will avoid all danger by keeping a mile from the shore.

Cano Island, lying 8½ miles off San Pedro Point, the nearest land, and 10½ miles 309° from Llorena Point, is 1½ miles long, northeast by east and southwest by west, and ½ mile wide. It is covered with trees, rises on all sides with a steep ascent to a height of 404 feet, and the surface of the island is so level that the tree tops when first sighted, 20 miles away, present the appearance of low and marshy land rather than that of an elevated plain. It is surrounded by rocks which extend from its western side for upward of ½ mile; reefs also extend out some distance from the northeastern and southeastern points. Outside the reefs the water deepens rapidly to 10

and 15 fathoms. The best water for anchoring is northeastward of the island, but under no circumstances should a vessel go inside of 15 fathoms without sending a boat ahead.

Reef.—The coast between Llorena and San Pedro Points is bordered by a rocky reef studded with islets, the largest of which is San Pedro Rock, 217 feet high. Near Llorena Point the islets are high and wooded, like the bluffs from which they have evidently been detached, but at the northern end of the reef only black rocks are visible. The face of the reef is comparatively clean, and vessels will avoid all danger by keeping a mile from the shore.

Llorena Point, at the western extremity of the peninsula west-ward of the Gulf of Dulce, and where the coast turns sharply to the southeastward, is a high, steep, and almost perpendicular headland at the termination of a well-wooded plain 500 feet above the sea, and can be easily distinguished over 15 miles; on getting nearer, a number of red patches on the face of the cliffs will be seen among the trees. One mile below the point there is a little waterfall, with a descent of nearly 100 feet. The coast from Llorena Point trends 124° 13½ miles to Sal si Puedes Point, and is low and sandy, presenting no prominent marks. The Sirena, a small river, discharges into the sea 7½ miles southeastward of Llorena Point.

Corcovado Rock, about midway between Llorena and Sal si Puedes Point and 2 miles off the mouth of the Sirena River, is domeshaped and 60 feet high, standing out very prominently from the coast when viewed from a moderate offing. No dangers were found outside of it, but from the nature of the bottom, as indicated by the pointed rocks to the southeastward, it would be prudent to keep a mile off in passing, or in not less than 12 fathoms. The shoals between it and Sal si Puedes Point will be cleared by keeping outside of the range of Corcovado Rock and Llorena Point, while Chancha Pelona Rock off Sal si Puedes Point bears to the southward of 90°. Losing the wind and drifting with the current, which sometimes sets to the northward and westward 1½ knots an hour, as the depth is not too great, it is best to anchor.

Sal si Puedes Point is high and precipitous, and when bearing castward with an offing of 5 miles appears abrupt. It will be easily recognized from northward or southward by a natural terrace behind it. A reef, with rocks above water and others awash, makes out from it 1,200 yards to the southwestward.

Chancha Pelona, a circular flat-topped rock, 20 feet high, lies 1,100 yards 152° from Sal si Puedes Point; southward of it the soundings deepen in 2 miles from 10 to 120 fathoms.

Coast.—From Sal si Puedes Point the coast trends first eastward and then gradually east-southeastward for a distance of 17 miles to Matapalo Head, at the entrance of the Gulf of Dulce. It is low and

sandy and covered with trees all the way; immediately behind it a high and thickly wooded ridge overlooks the shore and terminates abruptly at Matapalo Head. The beach is steep-to, with 10 and 15 fathoms just outside the surf and 100 fathoms at 2 miles from the land, and usually lined with extremely heavy breakers.

Gulf of Dulce.—The Gulf of Dulce extends northward into the land about 10 miles and then northwestward 18 miles, with a width varying from 5½ to 10¾ miles, the width at the entrance, between Matapalo Head and Banco Point, being about 8 miles. It is but little frequented by vessels, and by estimation not more than 400 people inhabit its shores. Although very deep, it possesses numerous anchorages and has no known dangers at more than a mile from the land, with the exception of the bank facing the Coto River. This is the principal danger in the gulf, but as the sea generally breaks upon it, there is but little difficulty in avoiding it.

The upper and larger portion of the gulf is a remarkable basin, with an average depth of 100 fathoms, and as the deep water lies in close proximity to the shore, navigation here by sailing vessels, in the season of squalls and calms, must be attended with some risk.

Matapalo Head, the western entrance point, is high, steep, and covered with trees, terminating a mountain range over 2,000 feet high. Under it and just off the extreme point is Cape Rock, a conical rock that stands out prominently as the entrance is approached from the westward.

Matapalo Rock, dark colored and 10 feet high, lies ½ mile southeastward of the head, and is very conspicuous when viewed from southwestward or northeastward. Outside of the rock the water deepens rapidly, 50 fathoms being found within § mile, but on account of the ledges near it and a sunken rock midway between it and the shore vessels must be kept outside of it and should give it a berth of at least ½ mile.

The western shore of the gulf consists of a flat, well-wooded country at the foot of the hills, sandy as far as Arenitas Point and afterwards alluvial. One mile northeastward of Matapalo Head is a low point under the ridge, where the shore changes direction to the northward, and 300 yards off it a sunken rock. Sombrero Point, $2\frac{1}{2}$ miles farther northward, is bordered by a reef extending from it about $\frac{1}{2}$ mile, with a number of black rocks noticeable at low tide. Tigrito Point, $2\frac{1}{2}$ miles northward of Sombrero, also has a reef extending from it $\frac{3}{4}$ mile.

Arenitas Point, 10 miles northward of Matapalo Head, is a low, narrow, sandy point or spit projecting about $\frac{1}{2}$ mile in a northwesterly direction. A coral reef, $\frac{1}{2}$ mile long, with less than a fathom of water over it and steep-to at its outer edge, lies 600 yards eastward of the spit; close to its northern end the depth is 40 fathoms.

Behind the point, and just at the mouth of a small creek that enters from the southward, is the village of San Domingo, or Punta Arenitas, with a population of about 200, made up of half-breeds, Indians, and negroes. Only two or three houses can be seen from below the point, and even after turning it the village is not easily distinguished against the woods. Except in thick weather, the anchorage may be easily found by the marks on the opposite shore near Golfito, Adams Peak bearing 48°.

Anchorage.—The anchorage above the point is off the mud flats in front of the village. A vessel making this anchorage from the southward should keep over ½ mile from the shore until the end of the spit bears to the southward 225°; she will then be past the upper end of the coral bank and can steer for the anchorage. The mud flats make out nearly 300 yards, and ¼ mile farther out the depth is 20 to 25 fathoms; the lead should therefore be kept going, and the anchor dropped as soon as 12 or 15 fathoms is obtained.

Vessels making a short stay may anchor on the broad, shelflike bank southeastward of the point and below the coral reef. A good position is in 10½ fathoms, ½ mile from the shore, with Arenitas Point bearing 303° and Tigrito Point 175°. This anchorage, being exposed to the sea breezes, is free from the excessive heat felt northward of the point.

Supplies.—Bullocks, poultry, and fish can generally be purchased at reasonable rates, but the wells of the town are sufficient to supply only the inhabitants, and vessels needing fresh water must send their boats, between the half flood and half ebb, to the Tigre River, 3 miles above the anchorage, filling from a small stream that joins the river a mile above the mouth.

El Rincon.—About 8 miles 307° from Tigre Point, at the mouth of the Tigre River, is Palmas Point, the shore between them receding 1½ miles; and 4½ miles beyond, at the northwestern extremity of the gulf, is El Rincon Harbor, formed behind a low point covered with trees, which projects from the southwestern shore 1 mile to the northward, the little bay thus formed affording the only secure anchorage above Golfito. From the end of the point a sand spit extends northward about 200 yards, part of it above high-water mark, and the depth just outside of it is 20 fathoms. The Rincon River falls into the bay here, dividing the point into two unequal parts, that to the eastward being called Isadora Point; at low tide the water of the river is fresh nearly to the mouth. There are three or four huts on the northern and western shores, with a little cleared land about them, but only bananas and plantains are raised. The bay is surrounded by the spurs of the Sierra Sierpe, the distance across the ridge to the sea being only 93 miles.

A shoal with ½ fathom over it makes out 800 yards from the coast off a small point 2½ miles below Isadora Point and 1¾ miles above Palmas Point, the depth at the outer edge being 20 fathoms. With this exception the shore between Arenitas Point and El Rincon is free from danger and may be safely coasted at ½ mile, the soundings at that distance varying from 20 to 50 fathoms.

Tides.—At El Rincon the lunitidal interval is 2h. 45m.; springs rise 10 feet; neaps 5.4 feet.

Directions.—To make the anchorage in El Rincon Harbor, it is only necessary to keep midway between the shores, which gradually approach each other, and when the point and sand spit are made out, to round the latter at a safe distance.

El Rincon to the Esquinas River.—From El Rincon the shore line of the head of the gulf has a general easterly trend to the Esquinas River, which enters the gulf at its northeastern angle. Bluffs of moderate elevation rise abruptly, and the shore is indented by several small bays where the water is shoal enough in places to anchor, but vessels without a chart should not attempt feeling in with the lead, as some of the reefs have 50 fathoms close to their edges. The islets marked on the chart show distinctly against the bluffs, and will assist in finding the anchorage. The valley of the Esquinas is a mile wide, and across the end are mud flats and sand bars that choke the several mouths of the river, and make it difficult for even boats to enter.

Esquinas River to Golfito.—From the mouth of the Esquinas River the shore trends southward $2\frac{1}{4}$ miles to Esquinas Point, thence southeastward $2\frac{1}{2}$ miles to Copaiba Point, thence eastward then southward about $4\frac{1}{2}$ miles to San Juan Point, and thence eastward 3.3 miles to the northern entrance point of Golfito; between these prominent points the shore recedes in successive bays or bights, two of the indentations being of considerable depth, and from it all the way arises a bold mountain ridge. Deep water lies in close proximity to the shore, the soundings increasing in some places to 100 fathoms at $\frac{1}{2}$ mile from the beach.

A large rock lies close off San Juan Point, and 400 yards farther out is a small black rock that hardly shows at high water. Just above the point are several cattle ranches, occupying the small patches of level ground between the bluffs, to which the name of San Jose is given.

Golfito, though small in the extent of its anchorage, is a fine land-locked harbor lying opposite Arenitas Point and 15 miles northward of Banco Point. The entrance, open to the southwestward, nearly a mile long and 800 yards wide, leads into the northwestern end of the bay, which extends 3½ miles to the southeastward with an average width of over a mile. The water is shoal throughout the southern

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half of the bay, the head being bordered by mud flats which dry at low water. A small islet, 175 feet high, lies in the center of the southern part of the bay. A wooded hill, 862 feet high, rises from the low sandy peninsula bordering the south side of the entrance, and as the shore on the north side is high and abrupt, the entrance looks like a canyon or mountain pass. Southward of the hill a low, flat, narrow neck of land separates the southern end of the bay from the gulf. Another hill stands close to the beach a little over a mile below the neck, similar in appearance but slightly higher and more conspicuous to vessels running up the gulf, as the coast below it is comparatively flat for some miles. Behind the bay is a steep ridge, 1,400 feet high, and near the northwestern end, rising 300 feet above the crest, is the conical summit of Adams Peak, 1,726 feet high.

The channel carries a least depth of 6½ fathoms to an anchorage in 6 fathoms just within, at the northern end of the bay, the soundings being quite irregular; outside the entrance the depth increases rapidly from 17 to over 50 fathoms. A shoal just covered at low water lies ½ mile 30° from the end of the low peninsula on the southern side of the channel, and is connected therewith by a sand bar with about 9 feet of water over it. Westward of the shoal another shoal with 2½ fathoms at its outer end makes out toward it from the northwestern shore, contracting the channel to a width of 500 yards, and about midway between the shoals is a 3-fathom spot, reducing the width of the channel for deep drafts to about 200 yards.

While the advantages of Golfito in its sheltered harbor and good depth of water have been long understood, a permanent settlement here has never been made.

Tides.—High water, full and change, at Golfito is estimated to be 3h. 18m.; mean rise of tides 8.5 feet; rise of springs 10.4 feet; neaps 6.7 feet.

Directions.—A vessel bound for Golfito should keep well offshore in running up the gulf in order to avoid the shoal that borders the coast as far southward as Coto Point and makes out ½ to 1½ miles, with but a few feet of water over it and from 20 to 50 fathoms close outside. It would be unsafe to attempt on an estimate of distance so narrow a channel as that between the 3-fathom spot and the shoal to the westward; a vessel drawing over 15 feet should therefore wait for high water or send a boat ahead to mark the end of the shoal. The summit of the hill 862 feet high, just southward of the entrance, in range with the extreme end of the peninsula, appears to lead through the channel, but should be tested by a boat before use.

On account of the great depth of water outside the entrance and the shoal coast to the southward, the lead can not be depended upon when the landmarks are obscured; in such case vessels should anchor northward of Banco Point and wait for the weather to clear. Coto River discharges into the gulf 4 miles southeastward from the entrance to Golfito. The shoal at the mouth makes out 1½ miles, and most of it uncovers at low tide, leaving two narrow passages with less than ½ fathom of water leading into the river, one along the northern shore and the other leading across the shoal in an easterly direction, a little to the left of a hut on Coto Point. The sea generally breaks on the bar, and as sharks are numerous the attempt to cross it is attended with considerable danger. Outside the shoal the water deepens at once to 30 and 40 fathoms.

Pavon Bay is a great semicircular bight of the gulf, with an opening 10½ miles wide between Coto and Banco Points, and extending within them 3½ miles. The 3-fathom curve lies at ½ to ½ mile from the shore, and outside of it there are no dangers, the water deepening very gradually to 10 fathoms at from 5 to 6 miles from the head of the bay. There is good anchorage, mud bottom, anywhere on this great bank, but exposed to southwesterly winds.

Banco Point, the eastern point of entrance to the gulf, distant 8½ miles almost due eastward from Matapalo Head, is not very prominent, but as the entrance is neared it will be made out at the foot of the northwestern slope of Platanal Point. There are a few detached rocks about it, over which the surf breaks, and shoal water extends from it about ½ mile; vessels should therefore give it a berth of at least ½ mile, at which distance they will have soundings in 9 and 10 fathoms.

Platanal Point, 3 miles southeastward from Banco Point, rises abruptly from the shore to the height of 1,170 feet, and at a distance appears to mark the eastern side of the entrance to the gulf. The mountains behind it are 2,300 feet high, and as the descent to the beach on each side is gradual the flat top is very conspicuous.

Directions.—The Gulf of Dulce lies in the great projection of the coast between Llorena and Burica Points, so that navigators without observations for several days and missing the entrance on either side by 30 miles would know by the direction of the coast their position with respect to the entrance. When in the offing the Cerro Sal si Puedes is the best mark, as it rises abruptly at Matapalo Head and runs northwestward 15 miles, gradually increasing in height from 1,200 to 2,200 feet. After rounding Burica Point, 25 miles southeastward of the entrance, Platanal Point will be easily distinguished.

Entering the gulf at night, the most convenient anchorage is in Pavon Bay, the 10-fathom line of soundings running about northward from Banco Point. Should it, however, be blowing heavily from the southewestward a vessel having run inside the heads 2 or 3 miles may steer about 327° for an anchorage on the western side of the gulf, as the lead will give 10 and 12 fathoms over a mile from any danger. Running in from the westward at nightfall and being

anxious to keep hold of the land, care should be taken not to mistake the Cape Rock just off the head for Matapalo Rock.

Burica Point.—From Platanal Point the shore sweeps around in a gradual curve, with deep water extending far into the bight, to a point distant 20 miles 143°, and thence trends 127° for 3 miles to Burica Point, which is at the extremity of the peninsula south-castward of the Gulf of Dulce. Behind the point is a group of hills, at a distance showing as an island to vessels approaching along the land.

Burica Island, nearly 600 yards in extent, lies about ½ mile off the point and is connected with it by a rocky reef. A black rock several feet above water lies ½ miles 297° and some sunken rocks southward of the island, which should not be approached within the 20-fathom line, or nearer than a mile.

The point may be seen in clear weather from a distance of 35 miles, and is thus an excellent landfall for vessels from either eastward or westward. The island being high and isolated serves as an excellent object for recognition when making the land from seaward.

Tidal stream.—In the vicinity of the point the flood stream sets northwestward with some strength; vessels should therefore avoid being becalmed on its southeastern side.

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CHAPTER XII.

COAST OF PANAMA—BURICA POINT TO CAPE MALA, WITH ADJA-CENT ISLANDS.

Coast.—Between Burica Point and the southwestern extremity of Parida Island, 32 miles 85° from the point, the coast recedes 17 miles in a gradual curve, forming a large bay within which are no known dangers. On the northern shore, which is low and wooded, are the small rivers Bartolome, Pinos, and Piedra, but no port or place of resort. The western shore is higher and deep water approaches nearer to it. The open anchorage along the coast is considered in general safe.

The delta of the Rio David lies on the eastern side of the bay, northward of Parida Island, and is formed by numerous low islands fronting the coast for a distance of 17 miles, from the Boca San Pedro on the westward to Boca Chica on the eastward, covered by extensive shoals with heavy breakers. Within the islands the low coast is a labyrinth of small streams and esteros.

David Bay lies between Parida Island and Burica Point.

Boca San Pedro—Bar.—Boca San Pedro, 30 miles 61° from Burica Point, is the direct entrance to the Rio David, and is 12 miles distant northwestward from Santa Cruz Point, the southwestern extremity of Parida Island. As before mentioned, it is deeper than either of the other entrances to the inner navigation, but, being exposed to the southwestward, is subject to a heavier sea. The channel between heavy breakers on both sides, extending at least 2 miles from the shore, though subject to much change, carries depths of 4 fathoms or more, until above San Pedro Point, the western point of entrance; ½ mile above this point is convenient anchorage in 4½ or 5 fathoms, and the river is navigable at high water as far as Pedregal, some 10 miles from the entrance, for vessels up to 13 feet draft, but by a very tortuous and narrow channel, with high mangrove bushes growing to the very edge; it should by no means be attempted without thorough local knowledge.

Pedregal, the head of navigation on this river, is a village with fair wharfage, alongside of which steamers lie, the whole of the traffic with Ciudad de David passing by this route, that city having a population of about 5,000 and being the center of distribution for the Province of Chiriqui. At least 10,000 head of cattle are exported every year. Meat, poultry, rice, yams, and fruit are abundant and cheap. Flour is expensive.

Inland navisation.—Steamers pass by the Boca del Cuatro Calles Channel, an intricate passage northward of the islands, from Horconcitos into Rio David. By this route, vessels of 12 feet draft should so time their leaving Horconcitos as to carry the rising tide through the channel, and come to an anchor near San Pedro Point during the ebb and four and one-half hours of the succeeding flood, then weigh and proceed to Pedregal. If bound from Pedregal to Horconcitos, the whole run, about 33 miles, may be made without a stop.

Climate.—In the river and coastal navigation of this hot and moist region, great precautions are requisite to counteract the effects of climate; fevers often resembling the yellow fever both in suddenness of attack and violence of symptoms being very prevalent and requiring similar treatment. From June to November is the worst season, during which period all the inhabitants able to do so migrate to the higher lands. The climate in the dry season, at the anchorage at San Pedro, is not considered unhealthy. The nights are agreeably cool.

Cludad de David, the capital of the Province of Chiriqui, with 9,000 to 10,000 inhabitants, lies about 10 miles northward of San Pedro Island and the river mouth, and about 2½ miles from Pedregal. From the anchorage within San Pedro Point a least depth of ¾ fathom can be carried 10½ miles to Pedregal and a couple of miles beyond, the small coasting steamers of 200 tons ascending to the village, whence a road leads across a treeless grassy plain to the city. This plain gives good pasturage to many horses and cows. On nearing the city the character of the country changes and hills appear; the ground is more or less cultivated and is divided by fences. Nothing, however, appears of the town until the first houses are reached. It does not present a striking appearance, consisting for the most part of wooden houses with thatched roofs and clay floors. Nevertheless, there are many well-furnished stores.

Supplies.—Meat, poultry, eggs, rice, yams, and fruit are abundant; only flour is expensive. Good drinking water can be obtained from the river at the junction of the eastern and the western branch, above the Hacienda Pino.

Sevilla and San Pedro Islands abound in game, which is easily obtainable. The latter island is a private possession and consists of open grass fields and dark forests, giving support to some hundreds of cattle and numerous horses and swine. Of human dwellers there are here only the so-called matador, who has the supervision of the cattle, and a few nomadic Indian fishermen. The soil, though fruitful, is not cultivated.

Parida Islands consist of one large island, Parida, a much smaller island, Bolano, near the eastern part of the group, and a

crowd of islets and rocks between the two. They are uninhabited, except during the season of the pearl fishery, when a few people come to them.

Parida is of irregular shape, about 4 miles long north-northeast and south-southwest, and 2 miles wide in its widest part. It is well wooded but not high, and is the only one of the group that affords water. The only anchorage is at the northeastern end of the island, in 6½ fathoms, sheltered from the southward by the small long islet Gami; there is here a sandy beach for landing and plenty of good water. To reach this anchorage from the eastward, from a position westward of Viuda Rock, San Jose Islet should be steered for, then left to the northward, and a course steered for the northern point of Parida Island, keeping in from 7 to 8 fathoms but decreasing to 3½ fathoms as the anchorage is approached, when it deepens again to 6½ fathoms at the anchorage.

Chimmo Bay, at the southwestern end of Parida, is small, with depths of 2½ to 10 fathoms. The bay is fronted by Santa Cruz Islet; the passage in is northward of this islet, as rocks extend from it southward to the shore. A reef also runs southward a short distance from some islets on the northward side of the bay. Good fresh water may be obtained in the northeastern part.

Tides.—It is high water, at full and change, in Chimmo Bay at 3h. 15m. The rise is 10.5 feet.

Caution.—The southwestern point of Parida Island should be given a berth of about a mile, on account of some sunken rocks $\frac{1}{2}$ mile from it, with depths of 15 and 16 fathoms close to them.

A rock (Grono Rock), with a depth of 6 feet over it and 30 fathoms close to, has been reported to exist about 3½ miles 216° from the southern extremity of Santa Cruz Point.

Boca Brava—Bar.—The channel across the bar and the banks alter so much and so frequently that, although an 18-foot channel always exists somewhere, it is difficult to find, and it is not considered safe for vessels of more than 11 feet draft; also that, before attempting it, local knowledge should be acquired by a thorough boat examination at low water. This channel has been used for some months by vessels, sometimes drawing 13 feet 6 inches.

Having entered by this, the usual channel for vessels trading with Horconcitos, the track leads southward of Manglares and Muertos Islands and of the reef extending 1 mile eastward from the latter; from thence, turning to the northwestward, and about 2 miles farther on, leading through the very narrow pass between Rocky Point Reef and Rupert Jones or Table Rock, the latter a most dangerous rock about 25 feet square, steep to, and barely awash at low water, springs. From thence the channel gradually turns through north and northeast, passing between the Seventy-two and Submerged Rocks, and

on some 2 miles farther to the cattle corrals and shipping jetties forming the port of Horconcitos the town lying on the banks of a creek about 3 miles beyond the port.

The total distance from the Parida anchorage to the shipping jetties is about 15 miles, and after crossing the long Boca Brava Bar a depth of 3 fathoms may be carried up to the jetties.

Horconcitos is a straggling town of but little importance, but affording a plentiful supply of provisions.

Palenque anchorage.—Parida and Palenque anchorages are included between El Juco Point and Parida Island, 11 miles 252° from the point, and David Bay lies northwestward of that island; in fact, the whole space between Parida Island and Burica Point may be considered as included in David Bay. In Palenque and Parida anchorages and their approaches are numerous islnds and rocks, but with the assistance of the chart little difficulty will be experienced in selecting an anchorage. Boca Brava, the central entrance to the inner water, leads in almost a direct line from the northeastern end of Parida Island between Sevilla and Brava Islands. Boca Chica, formerly the entrance most used, but now scarcely used at all, being very narrow, tortuous, and intricate, lies through the islands at the eastern end of Brava. Boca San Pedro, the direct entrance from David Bay, lies between San Pedro and Sevilla Islands; the latter, though deeper than the others, is dangerous with a swell on from the southwestward.

Monitas are two islets on a reef lying about a mile southward from Juco Point; the southwestern islet has a close resemblance to a saddle. The channel between the Monitas and El Juco Point is not considered safe on account of the currents in it, though the depths is 7 to 8 fathoms; hence vessels making for Palenque anchorage generally pass to the southward of these islets.

Widow, lying 2\frac{3}{4} miles 191° from the southern Monita, is an isolated rock with a reef extending from it about \frac{1}{2} mile in a 113° direction. At low water four pinnacles are uncovered, but at high water only one is visible. As this rock and reef are both steep-to, with soundings of 10 to 12 fathoms close around, they require great care to avoid. It is said that, to vessels approaching Palenque anchorage from the southward, Widow may generally be known by breakers, but whether this is the case or not, it is a very formidable danger.

A sunken rock, the existence of which there is great reason to doubt, has been reported at about 4 miles 163° from Widow. The French surveying vessel *Obligado* sought for it unsuccessfully, although assisted in the search by a native who said he had seen the breakers on it. It would be prudent to exercise more than ordinary

vigilance when in the vicinity of this reported danger, especially as no soundings are recorded about the site.

Buey Rock is a dangerous rock of small extent in the middle of Palenque anchorage, with soundings of 5 to 7 fathoms close to it; it only uncovers at half tide, and does not show at all at high tide in fine weather. No well-defined landmarks can be given for this danger but it lies about 1½ miles 57° from the summit of the largest San Jose Islet. The chart shows that from the rock, the southeastern extremity of the San Jose group, the southernmost of the Linartes, and the northwestern tangent of Bolano Island, are all three in line.

San Jose Islets are a group of four wooded islets united by a reef, They are safe, except that the reef projects 1 mile to the eastward and nearly 400 yards northward and westward of them.

Bolano Island.—The islands which run to the eastward for 4½ miles from the southern end of Parida terminate in Bolano and Baraco Islands, which are the largest of the group. Some rocks under water lie ¾ mile southward of Baraco, and another lies nearly 2 miles 72° from it. Midway between Bolano and San Jose Islands are two rocks, named Linartes Island, ¾ mile apart, the northern rock bearing 328° from the southern one. A reef of sunken and visible rocks, 900 yards long east and west and 400 yards wide, lies 39° 1,800 yards from the south Linartes.

Linartes Islands range lights, flashing white, visible 8 miles, in line bearing 330° lead clear of this reef. The front light on the south island is exhibited at a height of 20 feet and the rear light, on the north island, at a height of 30 feet.

Palenque Island lies on the southern side of Brava Island; Deer Islet lies off the southeastern point of Palenque: The shoal water which limits the bay trends northeast by north and southwest by west from this island.

Playa Grande Bay, lying northward of El Juco Point and the chain of islands extending from the point to the Boca Chica, has many sunken reefs in it and has not been closely examined. The passage southeastward of Carre Island into the bay, nearly a mile wide, has 6 fathoms of water, and this depth is carried about \(\frac{3}{4}\) of a mile inside, gradually decreasing to 3 fathoms at about 700 yards from the eastern end of the bay, where there is good shelter for a small vessel. Chuchegal Bay opens from the northeastern part of Playa Grande Bay and extends about 1\frac{1}{2}\) miles northeastward to the base of Red Hill, but it has not been examined. The country behind the bay affords abundant pasturage for large herds of cattle.

Boca Chica, the channel between Saino and Ventana Islets, 3½ miles 297° from El Juco Point, is a narrow and dangerous entrance but little used, though practicable for small schooners of 100 tons and

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light draft, having as little as 6 feet in it at parts, and being very tortuous. It may be recognized by the rocks of Ventana Islet, which have been pierced by the sea. On the eastern side of the entrance is a rock named Lavandera, an isolated danger covered at high water, about 300 yards southward of Saino Islet, and which must be carefully guarded against, there being a depth of 5 fathoms close to its southern side.

Within the entrance, at the eastern end of Brava Island, the channel expands and forms an anchorage called El Pozo (the well) with a depth of 5 fathoms. The village of San Lorenzo is partly in sight at the western end, consisting of about a score of huts in the midst of orange and banana trees.

San Lorenzo Light, flashing white, has been established on the eastern side of the Boca Chica entrance to San Lorenzo.

Anchorage.—During the fine season there is good anchorage off the entrance to Boca Chica in 5 fathoms, sheltered from the northerly winds that prevail; but during winter, when southwesterly winds prevail, it is better to anchor farther out under shelter of San Jose Islet. A good anchorage may be picked up near the northeastern end of Parida Island, as previously described, very convenient for making an examination by boat, at low water, of the Boca Brava entrance, before attempting it in a vessel. The flood stream at the emborage off the Boca Chica has been observed to set 337°, and the emborage off the opposite direction, with an average strength of 1 mile an hour, diminishing in strength toward the San Jose and Monitas Islands. Within the entrance, and in the river, the current was much stronger.

Tides.—High water, full and change, at Palenque and Parida anchorages is at 3h. 15m.; springs rise 10\frac{3}{2} feet, neaps 8 feet.

Supplies.—At the village of Boca Chica or Puerto San Lorenzo, on the northern side of the river and 3½ miles from the sea, cattle, poultry, eggs, fruit, and vegetables can be procured. Water of good quality can be got from the stream immediately eastward of the village.

Directions.—Vessels coming from the eastward should pass between the Monitas and Widow Rock; vessels from the southward should pass between Widow Rock and the rocks eastward of Bolano; in either case steering for San Jose Islets on a bearing. If intending to anchor off Boca Chica: When westward of Widow Rock steer for Carre Islet, and when ½ mile from the southern point of that islet, continue along the southern side of the islets for the anchorage. If for the Parida anchorage, see the description previously given, but the chart, eye, and lead are probably the best guides.

Ladrones Islands are two rocky, barren islets of moderate height, and together not more than a mile in extent, lying 14 miles,

200°, from the southwestern point of Parida. They are very steep-to, with 70 fathoms close to their southern edge. The only known dangers are some rocks extending from them to the northward about 2 miles, and a very dangerous reef at 4 miles in the same direction, with only 6 feet of water over it at low tide. As this reef is only shown by breakers when there is a stiff breeze, it must be carefully guarded against.

Montuosa Islet, lying 27 miles 155° from the Ladrones and 22 miles westward of Coiba Island, the nearest land, rises to a height of 500 feet and has its summit covered with cocoa palms and other trees. A narrow reef partly above water extends from it about 3 miles in a westerly direction, and a reef also runs off from its southeastern side. The bottom on the southern side of the island and also the shore near the sea is rocky. A sandy beach lies behind some little creeks that run in between the rocks, which afford a safe landing place for boats.

The position of this island is doubtful, reported 1 mile to north-eastward.

Secas Islands are a group consisting of three principal islands and numerous islets and rocks, covering an extent of $5\frac{1}{2}$ miles in latitude by 3 miles in longitude, and lying about 15 miles from the coast between David Bay and Port Nuevo. About and among them are no known sunken rocks the positions of which are not usually indicated by breakers. Small vessels may find good shelter here, and on some of the islands a landing may be effected, but no fresh water can be obtained. The best anchorage is stated to be in 10 to 12 fathoms, on sand.

La Bruja Rock, about 3 miles eastward of the northern end of the largest island, is a formidable danger, especially at night; it is stated by some authorities to be almost awash at low water and by others to be awash at high water, and is surrounded by depths of 20 to 24 fathoms.

Contreras Islands, a group about 14 miles southeastward of the Secas and 9½ miles northward of Coiba, composed of two principal islands with many small islets and rocks, are uninhabited and have no good anchorage. Vessels may approach these islands without hesitation if due precaution be taken, as the depths near them are from 30 to 40 fathoms, and it is believed that there are no sunken dangers among them that are not marked by breakers.

Prosper Rock lies about 1½ miles southward of the southern island and has the appearance of a black tower; a reef which uncovers at low water at spring tides extends from it about 200 yards in a southwesterly direction. It is not safe to pass between Prosper Rock and the islands on account of a reef midway in the channel, which is partly dry at low water. Prosper Rock has also a reef extending

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from it about 200 yards in a southeasterly direction, always visible at low water springs, and often uncovered.

Coast.—At 1½ miles eastward of El Juco Point the coast turns northward for 3½ miles to the mouth of San Lorenzo River, and thence trends 103° for 20 miles to Espartal Island at the mouth of the River of Pueblo Neuvo. Nearly all this shore is low and fronted by a sandy strand; the entrances of the various rivers are barred and can usually be recognized by the white trunks of the mangrove trees, the tops only being in leaf. About a dozen miles inland is a range of hills between which and the sea is a wooded plain.

There are no known sunken dangers along this coast and vessels may skirt it at a distance of 2 to 3 miles in soundings of 6 to 11 fathoms. Some cliffs of red color eastward of San Lorenzo River and ending at about 13 miles from Pueblo Nevo are very conspicuous.

Venado Islands, on the eastern side of El Juco Point, consisting of one large island near the point and three small ones on a bank about a mile to the eastward, are said to be a good mark for vessels approaching from the eastward.

San Lorenzo Bay, formed by the bend in the coast eastward of El Juco Point, is so thickly strewn with rocks that all vessels should avoid entering it, and for the same reason the river can be approached only in boats. A considerable village lies on the San Lorenzo River a few miles from the sea.

Port Nuevo.—The entrance to Rio San Lucia or Remedios lies between the Cayado Peninsula on the southward and the Belitre Bank on the northward, which latter extends to the westward from the southern point of Insolita Island for about 1½ miles and forms a natural breakwater for the anchorage.

Entrada Point Light, flashing white with red sector, is exhibited on the southern side of the entrance to Port Nuevo. (See Light List.)

Landmarks.—The position of the entrance, from whatever direction approached, may be at once recognized by the peculiar formation of the Cayado Hills, which from a distance appear as two islets. Sugarloaf Hill, 540 feet high, standing close to the shore, near Espartal Island, is a good mark for the port, as are also the two wooded islets, Silva de Tierra and Silva de Afuera, distant, respectively, 1½ and 4 miles from Entrada Point. Espartal and Insolita, two large, marshy mangrove islands, front the coast for about 8 miles, forming the river delta.

Intrusa Islet, rocky and steep-to, lies on the northern side of the channel, within the entrance, 1 mile from Entrada Point and nearly halfway between Aguda Point, the southern extremity of Insolita Island, and the southern shore.

Robalo Island, \(\frac{3}{4}\) mile northeastward of Aguda Point, is nearly \(\frac{1}{2}\) mile long and \(\frac{1}{4}\) mile wide. The passage eastward of Robalo is not recommended, numerous rocks having been reported to be in it. A mud bank extends some distance to the southward of the island.

Opposite the northern end of Robalo Island the remarkable Dedo (finger) Hills, about 1,500 feet high, extend in a northeasterly direction, the line of direction of the hills passing through Entrada Point.

Herron Islet lies near the eastern bank of the river, opposite the southern end of Robalo Island.

Shoal water extends 1 mile offshore on the southern and eastern sides of the port.

Depths.—The entrance channel carries a depth of 6 to 8 fathoms at low water as far as Intrusa Islet, with a width of about 400 yards, Farther in the depths are uncertain and the channel liable to change, but in the fairway there should be nothing less than 2 fathoms at dead low water as far as Rocky Point. Off the western Rocky Point a dangerous stony bank extends about 100 yards, drying at half tide. At high water steamers of 11 feet draft go up to San Juan Enfrente wharf, and schooners work up the whole distance to the port of Remedios, which is about a mile from the town. Vessels remaining a tide at Enfrente have to lie aground and almost dry alongside the wharf on a bottom of soft mud.

No directions for this river can be given; the track as laid down on the chart is the best guide.

Anchorage.—Vessels of deep draft may anchor in 8 or 9 fathoms, sand, to the southwestward of Intrusa Islet; those of moderate draft will find ample space farther to the eastward, where they will be well sheltered. There are a few shoal spots of 2½ and 3 fathoms, which restrict the inner anchorage considerably for large vessels.

The shores of the bay are inhabited by a few Indians in huts scattered along the beach, and there are said to be a number of small villages on the numerous streams that fall into the river.

Westerly winds, which are frequent from June to October, are said to send occasionally a heavy sea into the river, which causes considerable inconvenience to vessels anchored near Intrusa Islet; at such times it will be advisable to shift berth into the inner anchorage.

A venomous species of snake, the bite of which is fatal, is numerous on the mainland and islands.

Supplies.—Some poultry, vegetables, and fruit can be obtained from the shore near the anchorage. Good water may be procured from a brook which falls into the small bay on the eastern side of Entrada Point. Provisions can be obtained at Los Remedios.

Directions.—Port Nuevo is now entered on an 101° course passing southward of Silva de Tierra and Insolita Islands. The entrance

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is very narrow between Belitre Bank on the northward and Entrada Point on the southward, the old and more direct route between Espartal and Insolita Islands having silted up and become impassable.

When nearing the port a northerly course should be maintained, keeping about half a mile from the shore just below Entrada Point, in order to avoid the shoal water westward of it and the bank with 4 to 5 fathoms on it extending southeastward from Silva de Tierra Island. This course will insure 6 fathoms of water. When Intrusa Islet opens off Entrada Point, steer for the islet, passing close to the point, and when within it, steer 101° and follow the track as laid down on the chart.

When within the entrance, the course of the river curves rapidly round to northeast, north, and north-northwest; about 8 miles up, abreast of Rocky Point, it divides into three streams of which Rio Jacobe, the eastern, and Rio Santiago, the central, are of no consequence, but Rio San Lucia, the western branch, has considerable traffic, San Juan Enfrente, a cattle-shipping place, lying on its right bank about 2½ miles above Rocky Point and the city of Los Remedios on the same bank some 12 miles higher. Besides cattle there is an export trade in hides, rice, maize, tobacco, and sarsaparilla. As above stated, the track as laid down on the chart is the best guide for the river.

Tides.—It is high water, at full and change, at 3h. 10m. Springs rise 12 feet.

Coast.—From Port Nuevo the coast has a general trend of 150° for 23 miles to the entrance of Bahia Honda and is quite irregular in outline, being intersected by several rivers and indented by a number of small bays, of which the principal are Pajaros, Rosario, and Monita, all of them open and exposed to winds from the westward. About 33 miles southward of Entrada Point is the Tavasera River, which has no bar at its mouth, a channel with from 2 to 3 fathoms leading into an anchorage ground of considerable extent, with a depth of only 1 to 4 fathoms. Negro Bluff, westward of the entrance, is at the southwestern end of a round-shaped peninsula about a mile in diameter, occupied by a low hill of gradual ascent and connected with the northern shore by a very narrow neck. Between the Cayado Peninsula and Negro Bluff the coast recedes considerably, forming an open bay which appears to be free from danger, with 3 to 4 fathoms at 1 mile from the low shore. The Nueces Rocks lie at the northern end of this bay, the entire group lying within 1 mile of the beach.

Below the Tavasera River the coast is fronted for a distance of 8 miles by a long sandy shelf, called the Playa Brava, extending from 1 to 2 miles from the low shore, with depths of 1 and 2 fathoms,

and covering in the southern part the mouth of Lavenia River, 7 miles from the Tavasera. This bank is steep-to, and should be approached with care, keeping outside the 10-fathom line.

Pajaros Bay, about 2 miles southward of the Lavenia River, between Pajaros and Muertos Points, is about a mile in width and depth, with from 16 to 18 fathoms of water. Rosario Bay, separated from Pajaros by a narrow peninsula ending in Muertos Point, is recognizable by the isolated pointed hill terminating this point, and by a small round islet, called Muela, in the middle of the bay, about a mile from the shore. Rosario Point projects into the bay at its middle, dividing it into two parts, the southern of which is called Pivay Bay. A stream discharges at the head of each bay.

Gorda Point, of blunt shape and 2 miles broad, separates Pivay from Monita Bay, which is so named from a wooded islet in its northern part near the shore. Ventana Point, limiting Monita Bay on the southward, is 1 mile northward of Roble Point, which fronts the northern side of Medidor Island and is $2\frac{1}{2}$ miles from the entrance to Bahia Honda.

These bays, being open to the westward, afford anchorage only in the fine season. In each bay are found a few Indian families, who live by hunting and fishing.

Medidor Island, of irregular shape and moderate height, about 1½ miles long and ½ mile in average width, lies about 2 miles northwestward of the entrance to Bahia Honda, and is separated from the coast by a narrow and rocky channel, less than ¼ mile wide, which is not recommended for use. Pacora or Trucha Islet, lying ¾ mile southward of Medidor, is about ¼ mile long and 100 yards wide. A reef extends about two-thirds across the passage, leaving a narrow channel between its end and the islet, with a depth of 24 fathoms. Both Medidor and Pacora appear to be bold and steep-to, the water being from 20 to 30 fathoms deep in their vicinity, but should not be aproached too closely on the northern and western sides on account of the deficiency of soundings.

Bahia Honda (deep bay), lying 14 miles northeastward of the northern end of Coiba Island and 23 miles northwestward from Zurron Point, the western end of Cebaco, is an excellent harbor for vessels of the largest size, being deep, safe, capacious, and very easy of access. The entrance, between Guarida Point and Centinela Island, is \(\frac{7}{8} \) mile wide, and the harbor within is 2 miles long and wide, exclusive of the extensive mud flats in the eastern part of the bay, deep water lying in general close to the shores, which as a rule are clean and safe of approach.

Guarida, the northern entrance point, is bold and clean, and may be approached close-to, there being 20 fathoms of water at from 100 to 200 yards.

Centinela Island, forming the southern entrance point, lies $\frac{\pi}{4}$ mile southward of Guarida Point; it is small and surrounded by rocks, which, on the southward, extend as far as Cono Islet; a detached reef lies about 400 yards to the northeastward. Centinela and Cono are separated from Cape Jabali by a narrow rocky channel with rocks on both sides and practicable only for boats.

Between Guarida Point and Centinela Island the depths are from 20 to 25 fathoms for almost the entire width of the channel, which is clear and free from dangers except the rocks and reefs close to the island. Within the entrance the depths decrease gradually to 10 and 12 fathoms at 11 miles.

Talon Island, lying about 1½ miles within the harbor and opposite the entrance, is about § miles long, north and south, and 120 feet high. Two small islets, Pueril and Espuela, lie, respectively, off the western and the southern point of Talon, and from the former islet a shoal and reef extend northwestward about ½ mile. Talon Island separates the harbor into two anchorages, Chinche Bay to the westward and Legamo Bay to the eastward, the former being much the larger. On the northeastern side of the island a narrow channel connects the two bays.

Chinche Islet is round and wooded, and lies in the northern part of Chinche Bay, about 600 yards from the shore; it is clean and safe of approach on all sides, with 10 and 11 fathoms close-to, to the southward.

Anchorage may be had in any part of the harbor, but the best berth for large vessels is in Chinche Bay southward of the islet, in from 10 to 14 fathoms, mud bottom, sheltered from all winds. The only dangers in this locality are a rock covered by 8 feet of water about ½ mile northward of Guarida Point, and the reef lying 300 yards northwestward of Pueril Islet. Legamo Bay is clean, with an anchorage extent of § mile and depth of 5 to 7 fathoms, completely sheltered by Talon Island.

Tides.—Lunitidal interval is 3h. 10m.; spring rise is 11 feet, neaps 5.9 feet. The tidal streams run from ½ knot to 1 knot an hour.

Supplies.—Vegetables and fruit are only obtainable in very small quantities. Water can be procured near a village on the southeastern side of the bay; a boat can anchor here in calm weather and fill with a hose. Very good water may also be procured from a cascade outside the harbor, on the northern shore, at 1½ miles from Guarida Point; the water falls upon a rock which affords facilities for fixing a hose.

The Indians are expert turtle catchers and will furnish a large quantity daily. Fish are abundant.

Directions.—The entrance of the bay does not make out well at a distance, but its location is so plainly marked by the islands Afuera,

Medidor, and Pacora that it is readily found. After making out Afuera, in mid-channel, Medidor will be seen, and should be steered for until Pacora is made out or the entrance is opened. Then steer for Guarida Point, which may be ranged close-to, and when past it head for Chinche Islet and anchor in 11 to 14 fathoms, mud bottom, sheltered from every wind. The best time to leave the harbor with a sailing vessel is in the morning, when the winds that precede the sea breeze come from the northeast to east. These are sometimes so light that the boats must be used to tow out. The channel between Medidor and the coast and that between Medidor and Pacora should not be used.

Coiba or Quibo Island, 21 miles long northwest and southeast and of a width varying from 3 to 12½ miles, is the largest island off this coast. The interior consists of fine plains covered with forest, and there is abundance of good water. It is of moderate elevation. There are several anchorages around its shores, but no harbor in which vessels may be protected from all winds. The western coast is clear of danger, but off the southern coast there are several dangers, mostly above water. Hill Rock, 2½ miles from the shore, is a dangerous shoal covered by 6 feet water; it lies 5½ miles 89° from David Point, the eastern end of Jicaron, and the same distance 244° from Negada Point, the southeastern end of Coiba.

On the southern coast, a shoal, nearly a mile in width, extends about 5 miles along the shore from Negada Point, the southeastern extremity of the island, to Racimo Point. Several shoal spots of 4 to 5 fathoms lie at 1½ and 2 miles southwestward of Negada Point, with deeper water inshore.

Barca Islet is a little over ½ mile southwestward of Racimo Point. Passage Rocks, a group above water, are about 2 miles westward of Barca, and Logan Rock, also above water, lies about 2,400 yards northwestward of the former, with soundings of 6 to 9 fathoms between them and the coast.

Damas Bay, on the eastern side of Coiba, between Fea and Clara Points, is the principal anchorage. It is $6\frac{1}{2}$ miles wide, and has a broad sand flat at its head through which a small stream, the San Juan, flows; there is good anchorage in any part of the bay, the depths gradually decreasing from 30 fathoms between the two entrance points to 10 or 12 fathoms within $\frac{1}{4}$ mile of the sandy flats at the head. Off the southern shore of the bay rocky shoals extend nearly a mile out. Intersecting these shoals is the harbor of Fea, an inlet well sheltered from all westerly winds, with depths of 5 or 6 fathoms, and well suited for the shipment of mahogany or cedar with which the island abounds, but at present there is little or no trade. The settlement of Guadia is at the head of the harbor, and affords an

excellent site for the construction of sawmills. Fruit, rice, maize, and fish are plentiful at this settlement.

From Fea Point to Negada Point shoal water extends ½ mile from the shore, and from Clara Point for a distance of 2 miles to the northward a shoal extends nearly a mile from the shore.

Arena Bay.—At Job Point, $2\frac{1}{2}$ miles northward of Clara Point, the coast turns westward for 2 miles, and then again to the northward, forming Arena Bay, in which the depth is convenient for anchoring over a large area, the depth at 2 miles from the shore being only 20 fathoms. At the head of the bay a sandy flat extends out $\frac{1}{2}$ mile, and through it flows the Juncal River.

Pesado Rocks lie in the northern part of the bay, 3½ miles from Job Point, and ¾ mile from the shore, and northward of these, about a mile, are the Cocos Islands.

Baltasar Head, the northern extremity of the island, has deep water close-to.

Tides.—It is high water, at full and change, at 3h. 10m. Springs rise about 12 feet. The ebb and flow are regular.

Supplies.—Except at Guadia, no fruit or vegetables are procurable; turtle abound, but they are hard to catch; crabs, cockles, and oysters are plentiful. In the woods monkeys and parrots abound. The interior is nearly inaccessible from the steepness of the cliffs and the tangled vegetation; explorers should beware of alligators and snakes.

Jicaron Island, or Quicara, 4 miles southward of Coiba, is 3\frac{3}{2} miles long, north and south, well wooded, and rises to a height of 830 feet. David Point, the northeastern extremity of Jicaron, is clear and safe of approach. Around the northwestern extremity there are numerous rocks and reefs, foul ground extending off \frac{3}{4} mile. A small group of rocks which seldom break lies 1\frac{3}{4} miles 291° from Ursula Point, the southern extremity of the island, with 23 and 27 fathoms close-to. The channel between Jicaron and Coiba is practicable but of very irregular depth.

Jicarita Islet, about 500 yards southward of Ursula Point, is $1\frac{1}{4}$ miles long and covered with coconut palms. The western two-thirds of the island is a rocky promontory about 250 feet high, tree-covered, but ending in bald cliffs at its western extremity. The eastern one-third of Jicarita is a tree-covered hill about 250 feet high, and a depression of about 100 feet separates the two parts. The water off the western end is deep and off the eastern end is foul with rocky reefs. An off-shore set of $\frac{1}{2}$ knot per hour was encountered in December, 1911.

Rancheria is a small island off the northeastern point of Coiba. There is a channel 14 miles wide between Coiba and this island, but,

as there are several rocks in the passage, it is not prudent to attempt it. Aaron Rocks are a group of islets about a mile northwestward of Rancheria and 1½ miles northeastward of Baltasas Head.

Afuera Island lies about midway between the northern point of Coiba and the mainland; it may be passed on either side, the only danger being a reef extending ½ mile off its southeastern point; at the extremity of this reef there is a black rock which almost covers at high water. Afuerita Islet lies close to the northwestern end of Afuera Island.

Afuera Island Light, flashing white, visible 9 miles, is on the western end of the island.

Rock awash.—A rock awash at low water, locally known as "The Widow," is reported to lie off the northeastern coast of Coiba Island, in a position from which the eastern point of Rancheria Island bears 270°, distant 2 miles, and the western extremity of Afuerita 17°.

Coast.—Brom Bahia Honda the coast trends southeastward for 20½ miles to Brava Point at the entrance of Montijo Bay, and is rugged, with several islets and rocks off it. At 2 miles from the land the soundings are 35 to 27 fathoms until the vicinity of the point is reached. Lorenzo Bay, about 5 miles westward of the point, is of considerable extent, but apparently foul, and has not been closely examined. In running from one bay to the other the coast should have a berth of not less than 3 miles.

Montijo Bay is at the head of the bight formed between Mariato Point and Cape Jabali. Near its head is Leones Island, and its entrance is fronted by Cebaco Island, round both ends of which latter is a navigable channel into the bay. Two considerable rivers, the San Pedro and San Pablo, discharge into the bay above Leones Island; and, as many towns and settlements exist on or near their banks, an important trade has of late years sprung up, the exports being chiefly cattle in large numbers, hides, maize, and tobacco; the imports, timber, barbed wire, dry goods, groceries, etc. The steamers of the Pacific Steam Navigation Co. call at least once a fortnight, and small sailing vessels do a large share of the local trade.

The San Pedro River is navigable for vessels of 11 feet draft and 100 feet in length as high as Remolinos, about 16 miles above Leones Island; the navigable channel is very narrow, rarely up to 200 feet in width, and above Remolinos so narrow that, though still deep, no vessel could turn; boats, however, proceed as far as the large town of Montijo, some 7 or 8 miles above Remolinos.

The San Pablo, unlike the San Pedro, is very tortuous and with many rocks in its bed; nevertheless, with local knowledge, it is navigable by similar vessels as high as Baranco Colorado, a distance of about 27 miles above Leones Island, following the course of the

channel; and it is on record that a vessel of 10 feet draft has reached the town of Sona, some 9 miles higher upstream. No stranger should think of ascending either river without the aid of local knowledge and experience.

Both rivers are tidal, but observations on this subject are entirely wanting.

Cebaco Island, fronting Montijo Bay, is about 14 miles long and irregular in shape, with some detached rocks off its western end. A sunken rock, known as English Rock, lies about a mile off the eastern end, and vessels entering the bay by the eastern channel should keep near the mainland in order to avoid it, having previously cleared the reef extending from Duartis Point.

Gobernador Island divides the western entrance to Montijo Bay into two channels, either of which may be taken, though the northernmost is the better, being wider and less exposed to the strong outward current from the bay. When the bay is fairly entered, vessels of light draft can anchor on its western side and find good shelter from almost all winds. Breakers extend some distance from the southwestern end of the island.

Puerto del Campo is a small port where cattle are shipped, on the banks of the narrow but deep Rio del Campo, carrying 6 to 8 fathoms, on the eastern side of Montijo Bay, abreast of Leones Island. Peña is a large village on the San Pedro, where supplies can be obtained; it is about half way up to Remolinos. Perdomo Islet, covered with trees, and conspicuous, lies just above Estrella Point and at the entrance of San Pedro River; to those locally acquainted it forms a useful mark in crossing the bar of the River San Pablo.

Dangers.—In the eastern channel above English Rock and the shoal water extending northward from Cebaco Island, the only dangers on the port hand are the Montijo Rock, close to Leones Island, and the Newton Rock, with 7 feet water, close to San Pedro River entrance. On the starboard hand, on the banks extending from the eastern shore, are the San Juan Rocks, above water, Hermonita Islet, and the Tres Hermanos Islets, the channel lying only 200 yards westward of the last named. Just above these, abreast of Leones Island and 3½ miles southward of Perdomo Islet, is the Whaleback Rock, which uncovers for an extent of about 200 feet, but is covered at high water, and on which stands an iron tripod beacon 30 feet high, surmounted by a barrel.

Directions.—The eastern channel is to be preferred if from the eastward, but should only be attempted with clear weather. Pass at least 1,000 yards eastward of English Rock until Brava Point is well open northward of Cebaco Island, then haul to the northwestward, passing southward of the San Juan Rocks, taking care

to avoid a 2-fathom spot charted about 3\frac{1}{2} miles 338° from the eastern end of Cebaco Island. When the westernmost of the Hermanos Islets bears 16°, steer for it and pass it not more than 200 yards distant. From thence a 345° course leads 150 yards westward of the Whaleback Rock, and to a good anchorage in 4 fathoms, with Perdomo Island bearing about 112°; or a vessel may anchor in 9 fathoms, with Whaleback Rock bearing 157° 1 mile. From the position described as the Perdomo Anchorage, a vessel bound for the San Pablo River should steer for its entrance for 5 miles across the Soná River bar, as it is termed, on a course 297°, keeping Perdomo Island dead astern on the opposite bearing. Any written directions for the navigation of either river would only tend to confuse.

Entering by the western channel, from a position 1 mile southward of Brava Point steer 89° until the passage between Gobernador and Cebaco appears nearly open; then steer 39° for a remarkable sugar-loaf on the eastern shore. When the eastern point of Cebaco and Duartis Point are in line, alter course for the western Hermanos Islet and proceed as before.

Duartis Point, the eastern entrance point of Montijo Bay, lies 6 miles southeastward of Cebaco. Foul ground extends from it nearly 2 miles to the westward.

The coast southward of Duartis Point is low and indented by two large bays with a small stream at the head of each. The Quebra Islets, 6 miles below the point, extend to the westward, about 1½ miles, from the bluff projection of the coast separating the two bays. Vessels should keep at least 2 miles from this stretch of coast, as it has not been closely examined.

At 14 miles southward of Duartis is a bluff headland, and ½ mile off it is the rocky but wooded islet Naranjas, which is steep, with deep water close outside.

Mariato Point, 5 miles southeastward of Naranjas Islet and 55 miles 90° from the southern extremity of Jicarita, is a bold headland marking a sharp turn of the coast; it is the beginning of the range of high coast land which terminates at Morro Puercos.

Landfall.—Mariato Point is a good landfall for vessels bound to Panama from the westward, as by keeping under the land to the eastward of the point they avoid the southerly set out of the gulf.

Morro Puercos, 27 miles eastward of Mariato Point, is a lofty headland forming the termination of the range of high coast land. The water off this coast is deep close to the rocks for two-thirds of the distance, with 100 fathoms within 2 miles of the shore; nearer Puercos Point the 20-fathom line is about 2 miles from shore. About 4 miles westward of the point and 1 mile from the shore is a reef above water; and 2 miles northeastward of the point, $1\frac{1}{4}$ miles from

shore, is a 3-fathom patch. The chart shows a 5-fathom spot, with 14 fathoms close-to, at 3\frac{1}{2} miles 105° from the point.

Coast.—From Puercos Point to Guanico Point, 7 miles to the northeastward, the coast curves in a double bight, and thence in a larger bight to Raia Point, off which, at ½ mile, are the Venado Islet and Reef. The Tomosi River is nearly 3 miles northward of Guanico Point, and about the same distance beyond the river, at the head of the bight, is a patch of rocks at a short distance from the shore. About 2 miles westward of Raia Point is the Juera River, accessible according to native report for vessels of any draft, having 10 or 12 fathoms depth and affording a supply of fresh water.

From Ganico Point to Cape Mala, 23 miles 66°, the coast is low and along it the depths are moderate.

North and South Frailes are two low, barren, flat-topped islets, of which the southern lies 11\frac{3}{4} miles 226° from Cape Mala, and the northern 2\frac{1}{4} miles 332° from the southern. A reef extends about 200 yards off the northwestern point of the southern islet, but with this exception they are steep-to and clear of outlying dangers, with 20 to 30 fathoms within \frac{1}{2} mile of the rocks. Although a good mark for Cape Mala in clear weather, at night or in the thick squally weather of this coast they are dangerous to vessels keeping under the land westward of Mala to avoid the current, as the lead gives no warning of their proximity; at such times they should be given a wide berth.

CHAPTER XIII.

THE GULF OF PANAMA AND PANAMA BAY.

General description.—Cape Mala on the west and Piñas Point on the east may be considered the limits of the Gulf of Panama. The line between these points, running nearly east and west, is 105 miles long, and within this line the gulf extends to the northward 92 miles, with the bay and city of Panama, Balboa, and the Pacific entrance to the Panama Canal at its head. Between the entrance points the 100-fathom curve trends slightly to the northward, the depths outside increasing rapidly to 1,000 and 2,000 fathoms, while within they decrease gradually to the head. The Perlas Islands are entirely within the 50-fathom curve.

The Isthmus of Panama encircles the gulf; in a restricted sense the name is applied to the narrow crossing between Panama and Colon, the two other narrowest crossings being distinguished as the Isthmus of San Blas and the Isthmus of Darien; the widths of the isthmus at these points, in the order here given, are, respectively, 31, 27, and 32 miles, the last distance being measured from the head of deepwater navigation at the mouth of the Savannah River in Darien Harbor.

The whole isthmus is comprised in the Republic of Panama (and Canal Zone), which extends from the Costa Rican boundary to the Colombian boundary.

Sailing Directions and General Information are published by the Panama Canal Zone Government, and are furnished free of charge to masters requesting them.

Climate.—The geographical position of the Isthmus of Panama, the absence of high mountains, and the vast extent of forests and other uncultivated parts, tend to produce a hot, rainy, and unhealthful climate, which, nevertheless, has been brought to an unusual degree of healthfulness through the efforts of the American sanitary engineers. Yellow fever formerly prevailed at times in an epidemic form, but has been entirely eradicated and malaria reduced to a point where the Canal Zone will bear favorable comparison with the eastern-central United States in this respect.

The wet season begins in May and lasts till November. The rains gradually increase until the season is fairly established, in

June, and continue through July, August, and September, ceasing in December.

About the end of June the rains are suspended for a short time, the occurrence of this phenomenon being so regular as to receive the name of Veranito de San Juan. The average temperature of the year is very high.

Winds.—The navigation of the approaches to the Gulf of Panama for a sailing vessel is one of the most tedious, uncertain, and vexatious undertakings known to the seaman. Between Cape Corrientes (latitude 5° 30' N.) and Panama the prevalent winds are from the northward and westward, with frequent squalls from the southwest between the months of June and December. In the Gulf of Panama the winds are regulated by the seasons; the prevalent wind, however, is from the northward. In the fine season, commencing in December, the winds are regular and constant, bringing fine, dry weather. To the southward of the gulf they blow much harder, and off the coast of Veragua (a Province of the Republic of Panama lying between the Isthmus of Panama and the Isthmus of Chiriqui) a double-reef topsail breeze in January and February is not uncommon. In April and May the northerly winds are less regular and have more westings in them, with calms, light sea and land breezes, and occasional squalls from the southwestward. In June the rainy season sets in and the southerly winds become stronger; still the northwest wind is mostly found after noon, and vessels sailing from Panama will generally have at all seasons a fair wind until south of Cape Mala.

Between the Galapagos Islands and the coast, westward of the meridian of 80° W. and south of the parallel of 5° N., the winds are between south and west all the year round, and, except between the months of February and June, they are of sufficient strength and duration to make navigation easy; but northward of latitude 5° N. and between 80° W. and 110° W. is a region of calms and doldrums, accompanied by rains and squalls. At Balboa the seasons, temperature, barometer, winds, and rainfall are slightly modified by local conditions. The northeast trades blow offshore at the Pacific entrance to the canal and the southeast trades on-shore. The force of the northeast trades is modified and lessened by crossing the Isthmus, and are not so strong as at Colon. Northers are practically unknown, and, with the exception of sharp wind squalls that sometimes accompany heavy tropic rains and a strong trade wind occasionally, both of which make it rough for small craft, there is no danger to be anticipated, and vessels can ride in safety throughout the year at single anchor and with a moderate scope of chain.

Currents.—The Gulf of Panama is subject to irregular currents, partly caused by the formation of the land and partly influenced by the Peruvian and Mexican streams, according to the varying

strength of each. Malpelo Island, which lies about 230 miles 205° from Cape Mala, is surrounded by strong and rapid currents; these have been observed to set in opposite directions, sometimes to the northeast and sometimes to the southwest. A steady current has been found to set to the northward after passing Cape San Lorenzo, at the rate of 24 to 36 miles per day, extending offshore about 60 miles. This stream runs along the coast, following the direction of the land, enters and makes a complete circuit of the gulf and the Panama Bay, and then sets with considerable force, especially in the dry season, to the southward down the western side of the gulf. After passing Cape Mala it meets the Mexican current from the west-northwest, causing tide rips, eddies, and the short choppy sea met with at the entrance to the gulf.

Soundings.—Soundings of 1,000 fathoms or more extend to within 5 miles of the entrance and to the coasts outside; but immediately upon entering the gulf it shoals rapidly to less than 100 fathoms and then more or less gradually until the head of the bay is reached.

Islands.—The islands in Panama Bay which are of interest from a navigational standpoint are in the northwestern part of the bay in four general groups, with Bona and Otoque Islands in one group; Tabega, Urava, Taboguilla in another; Flamenco, Perico, Naos, and Culebra in the third; and the Perlas Islands. Inshore and to the southward of the canal entrance are several others; but unless a vessel be out of the general track they are of little importance.

West coast.—Cape Mala, which forms the western point of entrance to the Gulf of Panama, is a low but bold point with outlying rocky ledges, having deep water close to them. The land from the northwest slopes gradually down to the sea at this point from a considerable distance, making the exact cape difficult to distinguish unless the breakers are seen. On opening the gulf around this cape a strong southerly set is generally experienced, especially in the dry season.

Cape Mala Light, flashing white, with red sectors, visible 18 miles, is exhibited at a height of 140 feet from a white skeleton steel tower on Cape Mala. (See Light List.) The light has been reported irregular.

Iguana Island, lying about 9 miles to the northward of Cape Mala, is a little higher than the adjacent coast, and thus forms a conspicuous object. A ledge extends about 600 yards from its south point, and the chart indicates a reef as extending about 2 miles east-northeast from its east point; also, a reef has been reported to stretch to the north-northeast from its north point; but otherwise the island is steep-to, with 15 fathoms in the channel of about 1 mile in width between it and the mainland.

Tides.—High water, full and change, at Iguana Island, is at 4 h.; springs rise 15 feet. The flood sets to the northward and the ebb to the southeast, the latter being considerably the stronger, especially between the months of December and June.

Mensabé Light No. 10, flashing red, visible 9 miles, is exhibited on the edge of the reef on northern side of the entrance to Mensabé, about 25 miles northwestward of Cape Mala.

Parita Bay, nearly 20 miles wide and open to the eastward, lies within Lisa and Antoine Points, the former point being 38 miles northwestward of Cape Mala and the latter 40 miles southwestward of Chame Point. From the cape to Lisa Point the shore is a hard bank with sandy beach in front; at the point mud flats begin and extend around the western side of the bay, the coast being a low mangrove shore, intersected by the mouths of no less than five small rivers; the land to the westward is also low, with several hummocks. The coast between the bay and Chame Point is a continuous beach, named Playa Grande, in front of a low wooded bank. There is a depth of 4 and 5 fathoms about 2 miles off this beach, except 162° from the Cerro Chame, where there is only about 4 fathoms at nearly 7 miles from the land, the bank extending from here to Chame Point.

Chitre Light No. 9, flashing white, visible 10 miles, is on the south bank of the Rio la Villia between Lisa and Estero Point.

Agua Dulce Dolphin Light No. 7, flashing white, visible 10 miles, is exhibited from a pile structure on Banco Negro, about 2 miles off the mouth of Rio Dulce.

Agua Dulce Light No. 8, flashing white, with green sectors, visible 5 miles, is on the north bank of the Rio Dulce.

Puerto Posado Light No. 6, flashing white, visible 5 miles, is in the mouth of Estero Viejo.

Anton Point Light No. 5, flashing white, visible 5 miles, is on Anton (Antoine) Point.

San Carlos Light No. 4, flashing white, visible 5 miles, is northward of Calabaza Point at the entrance of Rio Mata Ahogada.

Otoque and Bona Islands, with Estiva Islet and Redondo Rock, lying 6 miles southeastward of Chame Point, form a group similar but smaller than Taboga and Taboguilla, being cultivated and having a village, named La Goleta, in the bay on the western side of Otoque. Bona Island is the most southern of the Otoque group, 685 feet high, consisting of a single peak. Otoque Island has two hills, slightly lower than Bona Island, but from the northward or southward they are more or less blended and do not appear as separate islands until they bear to the eastward or the westward. They form good landmarks for vessels entering this side of the bay. Anchorage in from 10 to 14 fathoms may be found in any part of

the group, and all dangers are above water. The establishment of a light on Bona Island has been recommended.

Bona Island is a most important landmark; it is a small round island, about ½ mile in diameter, with a single peak 685 feet high; there is a short arm reaching out from the north shore. It is wooded, with a few cultivated patches; its shore line is either precipitous or in ledges. Immediately to the southward of the island and connected with it at low tide is a group of rocks, two of which are 145 and 175 feet high, respectively.

Bona Island Light, flashing white, visible 15 miles, is exhibited at a height of 700 feet from a white iron skeleton tower, 15 feet high, on the summit of Bona Island. (See Light List.)

Otoque Island.—Otoque Island, irregular in shape, about a mile in diameter, is 1 mile to the northward of Bona Island, and has two peaks, the highest of which is 630 feet; it is somewhat similar in formation to Bona Island, is wooded, and its shores consist of ledges and heavy shingle.

When approaching these islands from the northward or southward they are more or less blended, as stated elsewhere, and appear as one island.

Redondo Rocks.—Redondo Rocks are about halfway between these islands, three of them are about 10 feet above high water, and several others are bare at low water.

Estiva Island.—Estiva Island, just south of Otoque, is the remaining one of the group, and is of no importance.

Directions.—These islands should invariably be left to the westward, for while a channel exists to the westward of this group and of Taboga Island to the northward, it is more or less obstructed, and a vessel would pass close to several dangers which are avoided by keeping in the open water to the eastward of the islands, beside which, there is no distance saved by going inside.

Chame Bay, at the head of which is a small river of the same name, is nearly filled with large mud banks, the largest, the Cabra Loma, lying in the middle of the bay and on it Tabor Island. Chame Point, the southern point of the bay, is low and sandy, $5\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide; between it and Cabra Loma Bank is a convenient harbor, 2 miles long by $\frac{3}{4}$ mile wide, with from 3 to 8 fathoms water, there being 16 to 18 feet close to the beach.

Coast.—The coast from Chame Point to Bruja Point, a distance of 16 miles, forms a shoal bay with several outlying banks and rocky islets, and vessels should not approach this shore within the depth of 5 fathoms, which is in places 5 miles from the land. The Rio Caimito discharges at the head of the bay, about 15 miles southweastward of Panama. Vique Cove, with a small village, is 5 miles westward from

Bruja Point. About a mile northeast of Vique is a lofty treble-peaked hill 1,735 feet high, Mount Cabra, a conspicuous object for vessels bound to Panama. This hill is just westward of the Canal Zone boundary.

Valladolid Rock.—Valladolid Rock is a barren whitish gray rock in two parts, the higher about 80 feet in elevation and conspicuous when in the sunlight; there is bold water all around it. It lies a little to the westward of a line joining Otoque and Taboga Islands, and about halfway between them.

Chame Island.—Chame Island, 315 feet high, $2\frac{1}{2}$ miles south of Taboga Island, is wooded and conspicuous, with deep water close up to it.

Perique Rock.—Perique Rock, 55 feet high, lies immediately to the northward of Chame Island.

Taboga Island.—Taboga Island, the largest and most conspicuous island in this vicinity, lies about 6 miles to the southwestward of the canal entrance. It is about 2 miles long and its greatest width is 1½ miles. A cove on each side divides it roughly into two parts, the northwestern part being the larger and containing the highest peak, 1,010 feet in elevation. The smaller part to the southeastward rises to a ridge 665 feet in height, the northern slope of which is nearly bare of trees and shrubbery. The island is wooded, though cultivated in places. There is deep water close up to the shore within ½ mile on all sides. The town of Taboga, at which the canal maintains a hotel, is on the northeastern side of the island.

The Pacific Steam Navigation Co. has a supply station on this island, which has here some stores, a water tank with abundant supply of water, and a gridiron 300 feet long for the examination of vessels' bottoms at low tide.

The anchorage off the village is convenient, being about 600 yards from the shore, in 10 fathoms, with the peak of Urava in range with the high cliff of Taboga, and the church bearing between southwest and west.

Taboga Island Light No. 3, flashing green, visible 9 miles, is exhibited on the northwestern point of the island.

Urava Island.—Urava Island is less than ‡ mile to the eastward of Taboga, and is connected with it by a submerged.reef having about 2 fathoms over it at low water. It rises evenly to a peak 608 feet high except on its southeast side, which is nearly vertical for half the distance to the summit. The most noteworthy feature of this island is a narrow point running out to the southward, which is surrounded by a rocky ledge.

Terapa Island.—Terapa Island is a small rock 1 mile off this point.

Taboguilla Island.—Taboguilla Island is 5 miles to the southward of the entrance to the canal, and is a very important landmark. It is about 1 mile long and ½ mile wide, narrowing to a point at its northeastern end. It rises to a peak at a height of 610 feet; it is wooded. A short reef extends out from the north point of the island for a distance of nearly ½ mile at its widest part. The eastern side is rocky; and on it are two large rocks, the inner one only a few yards from the shore and the outer and larger one almost touching the inshore one.

There are three small islets at the southwest point, the inner two being connected by a ledge with Taboguilla at low tide and the outer two also joining it at this stage of the tide.

Taboguilla Island Light, flashing white, with red sector, visible 12 miles, is exhibited at a height of 200 feet from a white skeleton steel tower 15 feet high on a small island on the eastern side of Taboguilla Island. (See Light List.)

Farallon Rock.—Farallon Rock, 65 feet high, is $\frac{1}{2}$ mile south of Taboguilla; it is white and bare with a well-defined projection on top.

Rock.—A rock with only 3 feet of water over it at low water, and another with 19 feet, lie half way between Taboguilla and Urava Islands, just outside to the eastward of a line tangent to the eastern sides, and is a danger to navigation.

Landmarks.—These two groups of islands, namely, Bona and Otoque to the southward, and Taboga, Urava, and Taboguilla to the northward, with Bona and Taboguilla in particular, constitute the most important landmarks and fixes after entering Panama Bay.

Lying inshore of these groups, to the southward of the canal entrance, are the following, which are of less importance for the reason before stated—namely, that vessels should invariably keep to the eastward of the aforesaid islands.

Melones Island.—Melones Island, about 4 mile long, 80 feet high, lies about 2½ miles to the westward from the northern point of Taboga; it is flat on top, higher at its southern end; it is wooded and cultivated.

Melones Rocks, above water, lie ½ mile northward of Melones Island. A rock with 18 feet over it exists 321° ½ miles from Morro of Taboga, and there is a 29-foot patch about 5° 1,500 yards from the same place.

Bruja Point, about 5 miles northward of Taboga Island, is a nocky projecting point, marking a turn of the coast. Venado Island, 150 feet high; Cocovi Islet, 20 feet high; and Cocoviceta Rock lie southwestward of the point, all within a distance of 1½ miles; and Tortola and Tortolita Islets lie about 2 miles southeastward of the point and 3½ miles northward of Taboga; these islets are all within

the 3-fathom curve. From Bruja Point to the city of Panama shoal water extends about 2 miles from the shore and envelops all the islands on this side of Panama road.

Commission Rock.—Commission Rock is submerged and has a depth of 5 feet over it at low water. It lies about halfway between the canal entrance and Melones Island.

Tortolita Island.—Tortolita Island, 1 mile north of Commission Rock, is a small rock 43 feet high.

Changarmi Island.—Changarmi Island is 1½ miles west of the canal entrance.

Caution.—Under no conditions should a vessel go inshore of a line extending from Melones Island through Commission Rock to the entrance of the canal. The water to the southward and westward of the canal entrance is to be avoided for a distance of a mile to seaward of the above-mentioned line, as there is less water than shown on the chart owing to the dredging material from the canal channels having been dumped in this vicinity. The seaward face of this dump is marked by black nun buoys.

Batele Point, 1½ miles northeastward of Bruja, is the southern extremity, 102 feet high, of a large, round, hilly projection which forms the western side of Panama road. Changarmi Island, surrounded by the Pulperia Reefs, with Penamarca Rock at their northern end, lies 1½ miles from the point. Between Batele and Guinea Points is the leper colony of Palo Seco.

Guinea Point, 1½ miles northward of Batele Point, is the north extremity, 320 feet high, of the hilly projection above mentioned.

Farfan Point, about 1 mile northward of Guinea Point, forms the northern entrance to the Rio Farfan. The town of Farfan is situated on the southern entrance point.

Depths.—From Bona Island to the canal entrance it shoals gradually, and, if at night or during a heavy rain or thick weather, if there be any doubt about a vessel's position, she should anchor and wait for it to clear. Between Bona and Taboguilla Islands anchorage can be found in 20 fathoms.

Islands.—The third important group of islands, from a navigational standpoint, in Panama Bay lies within a radius of 1½ miles immediately to the northward of the canal entrance and consists of the islands of Naos, Perico, Flamenco, Culebra, and San Jose Rock.

San Jose Rock.—San Jose Rock, 96 feet high, lies ½ mile southeast of Flamenco. It is an irregular gray mass and serves as an excellent landmark for anchoring off the canal entrance. There is deep water within ¼ mile of it, but there is a rock with 14 feet over at low water about ¼ mile to southeastward. Without local knowledge, vessels standing in for the canal should anchor when San Jose Rock

bears north and not stand to the westward of a line running north and south passing through it.

Flamenco, Perico, Naos, and Culebra Islands.—Flamenco, Perico, and Noas Islands are wooded, but show signs of recent work in connection with fortifications; their sides, particularly the two outer ones, are steep, culminating in flat tops. No one is allowed to visit them without permission. They are joined to each other and to the mainland by breakwaters, the latter being over a mile long from Naos to the shore line, paralleling the canal at a distance of about 1,000 yards. The breakwater was built to protect the canal and keep it from silting, and to furnish railroad connection between the island and mainland. It is itself a good landmark, easily discernible.

Culebra Island lies in the bight between Perico and Naos, and is joined to the latter by a reef that bares at half tide.

Quarantine station.—The quarantine station is on Culebra Island, but it is the intention to move it in the near future to the made ground between Balboa and the inshore end of the breakwater.

Ancon Hill.—Ancon Hill forms the most conspicuous landmark for approaching the canal entrance. It is between Panama and Balboa; is the highest hill in the vicinity, being 650 feet in elevation. On the eastern slope the old administration building, of white stone with a red roof, is easily discernible. There is no longer a water tank in this vicinity, as shown on some of the old charts; in its place a stone reservoir has been built, and its white stone coping shows from seaward on a higher slope of the hill above the administration building.

The southwestern face of Ancon Hill has been divested of vegetation and is used as a rock quarry; the remainder of the hill is wooded.

Directions.—If, after rounding Taboguilla Island at a distance of about 2 miles, when it bears 220°, the group of islands above mentioned will be roughly in range with the summit of Ancon Hill bearing 330°, and if this latter course be followed until San Jose Rock bears 0°, distant about ½ mile, a good, convenient anchorage will be found in 8 fathoms, soft bottom, off the entrance to the canal.

Sosa Hill.—Sosa Hill, 363 feet high, lies between Ancon Hill and the canal, and around its base is built the new city of Balboa, the Pacific terminal port of the canal.

City of Panama.—The city of Panama occupies the peninsula to the eastward of Ancon Hill, and is plainly visible and easily recognized at any time after rounding Taboguilla Island.

At night the glow from Panama can sometimes he seen for 10 or 15 miles at sea, and will serve as a general guide in approaching the entrance to the canal.

Soundings.—The lead is of much assistance in approaching in thick weather; it shoals gradually from about 20 fathoms outside of Taboguilla to 6 to 9 fathoms in the vicinity of the entrance to the canal, and if there be any doubt as to position a vessel should anchor in 10 fathoms, which will be within 2 miles of the canal entrance.

Tides.—There is quite a large variation in the heights of the tide in Balboa; the mean rise and fall is 13 feet; springs 17 feet, neaps 8 feet. It is high water at the entrance to the canal, corrected establishment, at 3h. 2m.; low water at 9h. 12m.

Warning.—Material dredged from the canal is being dumped immediately to the southward and westward of the Pacific entrance of the canal, and vessels are warned that there is less water there than is shown on the charts. In order to be perfectly safe vessels should keep to the northward and eastward of the extension of the axis of the canal and to the eastward of a line running north and south through San Jose Rock and Taboguilla Island.

The dumping ground is marked by a line of black can buoys placed about $\frac{1}{4}$ mile to seaward of it and spaced $\frac{1}{2}$ mile apart. They are unnumbered.

These buoys will be moved from time to time, as occasion may demand, without further notice. During dredging operations they may be lighted at night with small oil lanterns showing white lights, but these are not to be depended upon by vessels, as they are only intended for the use of towboats engaged in dredging operations.

Anchorage.—There is good anchorage ground anywhere between Taboguilla Island and the entrance buoys to the canal, provided a vessel keeps well clear of the dumping ground and outside of the line of buoys marking it. A safe rule for those without local knowledge will be to bring San Jose Rock bearing north distant about \(\frac{3}{4}\) mile, with the entrance gas buoys bearing west, and anchor in about 8 fathoms; these bearings are approximate.

At night, after picking up the entrance range lights and channel gas buoys, it will be best to keep a little to the northward and eastward of the range and anchor in not less than 10 fathoms.

Owing to the large rise and fall of the tide, due allowance must be made to soundings; in case of doubt, or if tide tables be not available, 2½ fathoms should be subtracted from depths shown by the lead.

There is a very good berth in the space between San Jose Rock, Flamenco Island, and the channel buoys, with the center of Flamenco Island bearing 0° and San Jose Rock 56°, in 6½ fathoms, for medium-sized vessels.

Panama Canal—Pacific entrance.—The channel leading from the deep water of Panama Bay to Balboa and the entrance to the canal, passes between Guinea Point on the port hand and Naos, Perico, and Flamenco Islands on the starboard. This channel is 4 miles long, 500 feet wide, and dredged to 35 feet at mean low water.

Aids to navigation.—It is marked by a lighted range, and by red and black gas and spar buoys along the edge of the channel. The color of these buoys is hard to distinguish except when freshly painted, owing to the fact that they quickly become whitened with bird deposits. The range is formed by two white cylindrical towers built on the low land opposite Balboa; they are lighted by electricity, the front light being fixed and the rear flashing.

The gas buoys show red and flashing white lights, depending upon the side of the channel on which they are moored, the red on the eastern or starboard hand when entering show red lights, the black on the port hand show white lights; the buovs are moored in pairs. The gas buoys which mark the seaward end of the channel show a double flash; the remainder show a single flash if at turns; fixed if on straight reaches; hence the outer buoys can be distinguished by their double flash. The outer pair of gas buoys (Nos. 1 and 2) at the seaward end of the channel are established in 7 fathoms of water with San Jose Rock bearing 45°, distant 1 mile. The second pair of gas buoys (Nos. 5 and 6) are a little more than a mile from the outer buoys, with the center of Culebra Island bearing 43°. The third pair of gas buoys (Nos. 9 and 10) is slightly more than a mile from the second pair, abreast the middle point of the breakwater joining Naos Island and the mainland, with the north tangents of Naos and Perico Islands in range, bearing 96°. The fourth pair of gas buoys (Nos. 13 and 14) are 3 miles from the entrance buoys and about 13 miles from the frant range light, abreast the point where the breakwater joins the mainland, which bears 76°.

Guinea Point Beacon, formerly shown on some of the charts, has been replaced by gas buoy No. 13. Gas buoy No. 18 is on the eastern side of the channel, at the junction of the old French Canal and main dredged channel, opposite rear range light No. 4, which is situated on Farfan Point; it marks a 15-foot rock which lies clear of but just on the east edge of the dredged channel; its opposite is a black spar buoy No. 17.

Spar buoys in pairs are established as follows:

Nos. 3 and 4, about halfway between the first and second pairs of gas buoys, Nos. 1 and 2, and 5 and 6.

Nos. 7 and 8, about halfway between the second and third pairs of gas buoys, Nos. 5 and 6 and 9 and 10.

Nos. 11 and 12, about halfway between the third and fourth pairs of gas buoys, Nos. 9 and 10 and 13 and 14.

Between gas buoys Nos. 13 and 14 and the end of the Panama Railroad steel pier, which parallels the channel, there are established two pairs of buoys, as follows.

A pair of spar buoys, Nos. 15 and 16, about one-third of the distance from gas buoys Nos. 13 and 14 and the end of the pier.

A pair consisting of a black spar buoy, No. 17, on the west side, opposite gas buoy No. 18, which marks the 15-foot rcck near the intersection of the old French Canal and the new dredged channel; the pair is about two-thirds of the distance between gas buoys Nos. 13 and 14 and the end of the railroad pier, nearer the latter.

Spar buoy No. 19 is on the west side of the channel, opposite the end of the steel pier, but has no opposite on the east side.

Three lighted beacons on the west side of the dredged channel, each 50 feet back from the edge of the canal, will be established as follows:

No. 17, a pile structure, painted white, showing a white electric light for one-half second, then eclipsed for one second, visible 5 miles, abreast spar buoy No. 17.

Beacon No. 19, similar to beacon No. 17, but abreast spar buoy No. 19.

Beacon No. 21, a pile structure, painted white, showing a green electric light, with the same characteristics as Nos. 17 and 19; it is in the elbow on the west side of the harbor, opposite the dry dock, where the main dredged channel from the sea enters the harbor.

Balboa Reach, from Balboa Harbor to the approach to Miraflores Locks, is marked by a double range. The lights for the northbound course, Nos. 12 and 13, are in the vicinity of Miraflores Locks, those for the southbound course, Nos. 3 and 4, are on the western side of the canal, opposite and to seaward of Balboa. In both ranges the front light is fixed, the rear flashing.

The western range, Nos. 3 and 4, indicates the deep water on the western side of Balboa Harbor and should not be crossed to the westward.

Owing to dredging operations in Balboa Harbor, beacon No. 6 has been moved from the position opposite No. 5, as shown on the charts, and replaced by a red lighted buoy. It will be moved from time to time as dredging operations progress, until it is once more established on its original site.

The channel from Balboa to Miraflores Locks is indicated by beacons showing fixed white on the port hand, and fixed red on the starbcard, in accordance with the system throughout the canal.

On the west side of the channel, in the vicinity of Farfan Point, there are a number of old construction beacons, dolphins, and piles still standing, which should not be confused with the aids to navigation.

Directions.—Steamers from South American ports should lay a course either to sight Cape Mala, after the light has been established, or leave it about 15 miles on the port hand, while those from the

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northward should round the cape at a distance of about 5 miles, depending upon their reckoning and the state of the weather, whence, in both cases, they should lay a course to pass Bona Island on the port hand and then round Taboguilla Island on the same side, keeping it about 2 miles on the port beam, until its north end bears 225°, from which point the entrance-lighted buoys of the canal will bear about 315°, distance 4 miles.

There is deep water close to Bona, Urava, and Taboguilla Islands with no outlying dangers; and if they be given a berth of 2 miles it insures safety. There is a submerged rock, before mentioned, with about 3 feet of water over it at low water, just to seaward of a tangent joining the eastern sides of Taboguilla and Urava Islands, about halfway between them. With this exception there is no danger of any kind.

Currents.—There is a current of variable strength, but fairly constant in direction, setting to the westward across the head of Panama Bay and thence to the southward between Taboga Island and the mainland. This current when combined with the ebb tide has a velocity of from 1 to 2 knots at the time of spring ebs between and to the westward of Taboga and Otoque Islands. It reduces the velocity of the flood current, and its strength is less over the same area. Between Taboga and Otoque Islands the tidal currents, both flood and ebb, vary greatly in direction at different stages of the tide, and cross currents flowing east or west are frequently encountered near the shores of the islands and in the vicinity of Valladolid Rock.

In the vicinity of Chame Point tide rips have been observed. Between Cape Mala and Bona Island vessels are frequently set out of their course by the currents, and in thick weather it would be better to lay a course to pass 5 miles east of the latter. With a steady southeast wind the current is westerly, and vessels should be more particular to set a course to keep well clear of Bona Island.

The breakwater at the Pacific entrance extends from Balboa to Naos Island, thence to Perico and Flamenco Islands; its full length, including the islands, is about 2½ miles. It lies from 900 to 2,700 feet east of and for the greater part of the distance nearly parallel to the axis of the dredged channel, varies from 20 to 40 feet in height above mean sea level, and is from 50 to 3,000 feet wide at the top. It was constructed for a twofold purpose: First, to divert cross currents that would carry soft material from the shallow harbor of Panama into the canal channel; second, to furnish rail connection between the islands and the mainland.

Balboa.—The topography around the old town of Balboa has been entirely changed and it now becomes the site of the Pacific terminus of the canal. The port facilities of the place are thor-

oughly up to date in every respect and in proportions that are appropriate with the expected tonnage that will pass through the canal.

Balboa Harbor.—The harbor of Balboa is an artificial one, and operations are still in progress to enlarge it, and will be continued as commerce may demand. There is no anchorage room in the harbor; all vessels must go alongside of the wharves or moor to the dolphins on the west side. The harbor proper lies to the eastward of the Canal axis; it will be dredged to 34 feet at mean low water, with 39 feet alongside of the new wharves.

Piers.—Piers similar to those at Cristobal have been erected, and others will be added as commerce may demand. The old French steel wharf to seaward, paralleling the axis of the Canal, will be retained as long as necessary; a depth of 25 feet will be maintained alongside.

Dolphins and mooring buoys.—Dolphins and mooring buoys have been established opposite Balboa, on the western side of the Canal, for the use of vessels, but principally for those that come for the purpose of passing through the Canal and that do not take on or discharge freight or passengers. Vessels that expect to use these berths should have both anchors ready for letting go, and mooring lines ready as directed by the pilot.

Coaling plant.—The coaling plant at Balboa, near the dry dock, is similar in construction to that at Cristobal, but is smaller, having a capacity of 200,000 tons.

Oil wharf.—A concrete pier, known as the oil wharf, has been erected on the eastern side of the main dredged channel, about $\frac{1}{3}$ of a mile to seaward of the old French wharf, in the vicinity of the oil tanks on shore where oil will be delivered to vessels. The tanks have a capacity of over 449,000 barrels of fuel oil, 65,000 barrels of Diesel oil, and 5,000 barrels of gasoline.

Dry docks.—The main dry dock is situated at Balboa, and is capable of accommodating any vessel that can pass through the Canal locks. It has a length of 1,000 feet, a depth over the keel blocks of 29.3 feet at mean low water, or 43 feet at mean high water, and an entrance width of 110 feet. The entrance is closed by miter gates, similar to those used in the locks. The dry dock is of concrete resting on hard rock. Its equipment consists of a 50-ton locomotive crane, with a travel on both sides.

Shops.—The main shops and repair plant are situated at Balboa in the immediate vicinity of the dry dock, between it and the commercial piers, and have ample installation and capacity for making extensive repairs of any kind, on the largest vessels.

Floating cranes.—Two large floating cranes are available, should they be required, with a capacity of 250 tons each.

Water.—Water may be obtained for both drinking and steaming purposes alongside of the wharves, or at the anchorage outside.

Supplies.—Supplies of all kinds, including fresh and cold storage fruit and provisions, ship's stores. etc., can be obtained in unlimited quantities on application to the captain of the port or boarding officer.

Pilots.—Under no conditions will a vessel be allowed to enter or leave Balboa Harbor without a Canal pilot; vessels must invariably remain outside and await the pilot before entering; they will be boarded at the seaward entrance of the dredged channel.

Pilotage is compulsory, and vessels must have a pilot on board at all times when underway, mooring or unmooring, or when shifting berth in canal waters. Whether or not a fee will be charged will depend upon the subsequent movements of the vessel.

Quarantine.—The quarantine officer will board all vessels at the Pacific entrance, near the two outer buoys, and no communication of any kind will be allowed with the shore until pratique has been granted. It is very important that masters of vessels should thoroughly acquaint themselves with the quarantine rules and regulations, as they are very rigid and are strictly enforced.

Boarding officer.—The boarding officer will accompany the pilot to attend to the ship's papers, customs, immigration, take orders for coal, provisions, supplies, cables, etc., and attend to any other business which the master may desire.

Captain of the port.—As stated elsewhere, the captain of the port has charge of all matters in relation to shipping, both for the Canal and the terminal ports, and questions in relation thereto should be referred to him. He will give information, in writing or otherwise as requested, on matters relating to the Canal, harbor, navigation, weather, lights, tolls, measurement, provisions, supplies, coal, cables, or other subjects of interest. His office, together with that of the pilots, measurers, collector, and customs officer, is on the third floor of the Pacific Terminal Building, Balboa, in the immediate vicinity of Pier 18.

Communications.—Balboa is connected with Panama City, Colon, and the Canal Zone by telephone; to Ancon and Panama by both electric and steam railways, and is the Pacific freight terminus for the Panama Railroad from Colon.

Commercial offices.—The principal steamship agencies are on the second floor of the Pacific Terminal Building, Balboa, All the banks and the cable office are in Panama, though cable messages may be forwarded through the captain of the port, from Balboa.

Radio.—The Government radio station will handle commercial as well as official messages, through the local radio station at Balboa (call NPJ).

Chronometer comparisons.—Chronometer comparisons may be made at the office of the captain of the port.

Note.—For more detailed information mariners are referred to Tariff No. 2, of the Panama Canal, with latest Supplement. These contain a complete schedule of rates for supplies and services furnished to shipping.

Directions for the Canal.—For complete directions for the Canal and list of aids, mariners should consult Sailing Directions and General Information, published by the Panama Canal.

Cable buoy.—A green cable buoy is moored in about 6 fathoms of water 2,825 yards 61° from the tank on Culebra Island. The wreck of the steamer Lautaro lies sunk 1,750 yards 40° from the same tank and is marked both at the bow and stern by red and black horizontal buoys. A black can buoy is moored 1,800 yards northward of Perico Island.

Hermanos Rocks are three black rocks, visible at first-quarter ebb, lying nearly ½ mile south of the southeast bastion and 300 yards from the reef; detached rocks with 3 and 7 feet of water between them, visible only at low water springs, lie off their southeastern extremity, the outer one being 400 yards from the reef.

Buey Ledge, seen only at half tide, is the northeastern extremity of the rocky reef that surrounds the eastern and southern shores of the peninsula occupied by the city, with a width of from 500 to 1,000 yards. Immediately south of Buey Ledge, which lies 900 yards eastward of the northeast bastion, a deep indentation in the reef forms a bay in which, after half flood, there is easy landing on the sandy beach in front of the Monks Gate. The reef is marked by iron posts.

Knocker Light Buoy.—Extending southeastward from the Southeast Bastion for 800 yards is the reef, and for 800 yards farther are dangerous rocks, some drying. Among these are Taboga and Knocker Rocks. A black light buoy, showing a flashing white light, is moored outside these dangers.

Paitillo Point, 14 miles northeastward of the city, is a black rocky promontory with two small hills over it, and between them a rivulet admitting boats at high water; rocky ledges extend 300 yards from the point. Between Paitillo Point and Buey Point the shore recedes nearly 4 mile, forming a bay called El Puerto, the head of which is of mud, edged with a sandy beach, and the greater portion dry at low water springs. It is here that most of the minor trade of the gulf is carried on by means of bungos, large canoes made from trunks of trees, some of them though made of a single trunk measuring 12 tons; though clumsy in appearance they are well fitted for the navigation of the gulf, and bring to the city most of the tropical productions of the isthmus.

Sulphur Rocks.—This dangerous reef, lying 3,400 yards eastward of the southeast bastion, is about 4 mile in extent, north and south, and has two rocks awash upon the reef, with 6 and 9 feet around, and outlying patches of 12 and 14 feet. A shoal with a least depth 11 feet over it lies 1,300 yards eastward of Sulphur Rocks.

Daniade Rocks.—These four patches of conical rocks, lying on the eastern side of the Panama Road, about 2½ miles northeastward of Perico Island and 2½ miles southeastward of the city, have only 13 to 16 feet on them, with 3½ and 4 fathoms on all sides. They lie awkwardly in the track of vessels standing for the anchorage from the eastward and keeping their luff with the land breeze. These shoal spots are favorite fishing places, and canoes seen in their vicinity should be avoided by vessels, as they may be fishing on the rocks.

Panama Road, the anchorage off the city of Panama, although shoal and on the seaward side entirely unprotected, may be considered secure. The bottom, being of mud, holds well, and with good ground tackle and with common precautions a vessel might lie here with one anchor down all the year around.

The inner anchorage is in 2 fathoms about a mile eastward of the northeast bastion; the outer anchorage is in $3\frac{1}{2}$ to 4 fathoms about 2 miles southeastward of the city, or in 5 to 6 fathoms northeastward of Perico Island.

Light.—A fixed red light, visible 3 miles, is shown at the end of the railroad wharf, north of the city.

Tides.—The mean lunitidal interval at Balboa is 3h. 5m. The spring tides rise 15.9 feet, the neaps 8.7 feet.

Tidal streams.—The flood stream sets to the northwestward and the ebb stream to the southward, the strength varying from $\frac{1}{2}$ knot to $1\frac{1}{2}$ knots per hour, the ebb being stronger than the flood. The long swell which occasionally sets into the road ceases with the flowing tide.

Panama City, the capital of the Republic of Panama, with a population estimated at 30,000, stands on a rocky peninsula jutting out into the shallow water at the head of the bay, and was formerly a strongly fortified city. It has an imposing appearance from the sea; the churches, towers, and houses, showing above the line of the fortifications, stand out in contrast with the dark hills inland.

The principal streets extend across the peninsula and are intersected by the Calle Real, running east and west, which has a quiet and steady, but comfortless air. The houses are of stone, mostly in the old Spanish style, the larger ones with courts and patios; the public edifices, comprising cathedral, churches, convents, nunnery, college, theater, and market, are partly in ruins. The cathedral, a large lofty building on the west side of the plaza, is hardly worthy

of its situation, only the towers redeeming it from insignificance, forming in the distance an ornament to the city. The fortifications were well constructed, but are in partial ruins, the northeast bastion having fallen; the south and west ramparts are in fair condition and form a pleasant promenade. The streets are lighted by electricity, and there are electric railways and telephones. The water supply and drainage system are under the control of the United States Government.

The old city of Panama, built in 1518, stood at the mouth of a creek, about 4 miles northeastward of the present city. Old Panama was larger than the Panama of this day and a place of surprising wealth. The spot is now deserted, but well marked by a tower, an arch, two or three piers of a bridge, and some fragaments of wall. In the afternoon the tower is still a conspicuous object from the anchorage.

Sanitary conditions.—The conditions which were formerly very bad have now been eradicated by the American system of sanitation.

Hospitals.—At Ancon is one of the finest tropical hospitals in the world; it is equipped with 800 beds. The old St. Thomas Hospital at Panama is to be replaced by a modern structure capable of accommodating 600 patients. It is to be in the suburbs of the city.

Piers.—There are several piers, all small and dry at low water, and only available for small vessels and lighters.

Landing place.—The general landing place at high water is around Buey Point, inside the northeast bastion, at the market place known as "the steps." Great care is required when landing at Panama in steam cutters or other heavy boats, which can be effected only at nearly high water. Landing is made in small boats from ship's boats at Hotel Marina Landing.

Consul.—The United States is represented at Panama by a consul general and a vice consul general.

Quarantine.—The quarantine and sanitation of the port is under the Isthmian Canal Commission. The quarantine flag should be hoisted upon entering the port. All vessels are visited by the Canal Commission quarantine officer and a bill of health is required by him. Bills of health are issued by the collector of revenues for the Canal Zone, Ancon.

Passengers who have not been at sea for six days must remain in quarantine until that time has passed since leaving the port of departure.

Official calls.—Panama being the capital of the country, the visits of ceremony to be made by the commander of a visiting manof-war should be arranged through the American legation. Panama is not a saluting port.

Coast.—From Petillo Point to the Chepo River an extensive mud flat borders the coast the entire distance, fronted by a shoal bank, the edge of which lies from 3 to 5 miles from shore. Numerous small streams intersect the shore line. Vessels should not stand into less than 6 fathoms between Panama and Chepillo Island.

Chepo River, which enters the Panama Bay about 25 miles eastward of the city, comes from some distance in the interior, its source being far to the eastward, near the headwaters of the Savannah River. The entrance is to the westward of Chepillo Island, through a 10-foot channel about 600 yards wide. Ten feet can be carried to Anna Luz, 8 miles up the river, and 5 feet to El Capitan, 12 miles up the river. Both are very small villages. The largest vessels now using the river are of 35 tons.

Tides.—High water, full and change, at the mouth of Chepo River is at 3h. 40m.; tides rise about 16 feet.

Chepillo Island, lying off the mouth of Chepo River about 24 miles eastward of Panama and 2 miles from the coast, is 1 mile long by ½ mile broad, and very fertile; it is low on the northern side and rises by a gentle ascent toward the southern end, over which is a remarkable tree that forms an excellent mark to vessels bound up the bay. The southern end may be approached within a mile, but the other sides are shoal, and a reef extends ¾ mile off the northern point, following the direction of the channel.

Pelado Islet, lying 31½ miles southeastward of Chepillo Island and 4 miles west of Mangue Islet, directly off the mouth of Chiman River, is flat, of small extent, about 60 feet high, and treeless, but covered with a coarse prickly shrub; it is steep-to on all sides and forms a useful mark for vessels bound to Panama.

The coast between Chepillo Island and Pelado Islet consists of low river land with mangrove bushes. Of the several small streams, the principal are the Hondo and Corutu, both being shoal at the entrance. The land north of these rivers is of some elevation; Column Peak and Asses Ears, about 12 miles northward of Chiman River, and Thumb Peak, at the western extremity of the range, are conspicuous. Extensive mud flats, dry at low water, extend from 1 to 4 miles from the coast, and outside of the flats is a shoal bank the outer edge of which lies 7 miles from the shore. Vessels standing inshore should tack in 9 fathoms.

Chiman River, 32 miles southeastward of Chepo River, is wide at the mouth, but shoal, being nearly dry at low water, with small channels for canoes. The entrance is well marked by the wooded bluffs on each side, the Mangue Islet to the southward, and Pelado Islet in the offing; on the eastern side, under a hill, is the small village of Chiman.

Mangue and Majaguay are high and wooded islets lying, respectively, 3 miles and 2 miles south of the eastern entrance point of the Chiman River and at the western edge of a large mud flat, dry at low water, which extends to the northern bank of Trinidad River. There are 10 to 12 feet of water to the westward of the islets.

Trinidad River, about 9 miles southeastward of Chiman River, has a low recky projection forming its southern point of entrance. A 3-fathom channel was found into this river, extending 1½ miles from the point, beyond which distance it was not examined. The northern bank of the river is composed of mangroves, which continue along the coast from here to Panama, a distance of nearly 70 miles, except where interrupted by the bluffs of the Rivers Chiman and Chepo. Shag Rock, a barren islet with shoal water around it, frequented by birds, lies 2½ miles northward of the entrance.

The Pajaros are two small rocky islets, lying between 2 and 3 miles southward of the southern entrance point of Trinidad River and 1½ miles from the coast, with 4 and 5 fathoms off their west sides, but only 12 feet of water between them and the shore. From Chame Point southwestward of Panama to these islets the whole shore of Panama Bay is fronted by a shoal with 5 fathoms on its outer edge.

South Farallon Ingles is a small but high island, lying about 8 miles southward of the Pajaros and 19 miles southeastward of Pelado Islet, at the edge of the shoal off the River Buenaventura, with 12 and 15 feet of water on its western side. North Farallon lies \(^2\) mile to the northward and \(^3\) mile from the western entrance point to the river. It was in this river, in 1681, that Dampier and his party, being prevented by the Spaniards from going by way of the Santa Maria or Chepo Rivers, sank their ship when starting on their journey to the Atlantic; this they reached in 23 days at a point near Concepcion Cays, 60 miles westward of Golden Island, in Caledonia Bay, having traveled 110 miles and crossed some high mountains, though their common march was in the valleys among deep and dangerous rivers.

Gorda Point, 4 miles northward of the South Farallon, is bold and woody, with 4 fathoms close-to; above this point there is less swell than to the southward of it.

Brava Point and San Lorenzo Point, 2 miles to the eastward of Brava, lie on the northern side of the entrance to San Miguel Bay; both are edged with reefs and outlying rocks, on which the sea breaks with great violence, and this fact, together with the proximity of the Buey Bank, makes this part of the coast dangerous, and it should be avoided even by small vessels.

Buey Bank, lying about a mile southward of Brava Point, in the northern part of the entrance to San Miguel Bay, is an extensive.

shoal about 3 miles in diameter, which dries in patches at low water and on which a heavy sea breaks. A passage § mile wide, with 4 to 5 fathoms, lies between the bank and the shore, but subject to a heavy swell and not recommended for use. A spit with 12 feet of water extends 1½ miles off the southwestern side of the bank, and outside the spit the water deepens very gradually, the 5-fathom curve lying about 3 miles to the westward and 2 miles to the southward.

San Miguel Bay, on the eastern side of the Gulf of Panama, is 15½ miles wide between the entrance points, Brava on the north and Garachine on the south, and penetrates within the points about 20 miles to the eastward. Between San Lorenzo Point and Patena Point to the southeastward, the bay narrows to about 7½ miles, expands again within to 11 miles, and again narrows to 4½ miles between Pierce and Virgin Points; thence continues a curved and gradually narrowing channel, terminating in the land-locked and spacious, but comparatively shallow, Darien Harbor, formed by the junction of the Rivers Savannah and Tuyra.

Across the entrance of the bay and for about 9 miles seaward extends a flat bottom with depths from 5 to 8 fathoms, but the water gradually deepens within the bay, and through the Boca Grande the depths are from 11 to 16 fathoms. Across the entrance flat a depth of 7½ fathoms can be carried, and thence to Darien Harbor more than 8 fathoms.

San Miguel Bay was well known to the buccaneers, who used it as the entrance to the Pacific and terminus of their overland journeys from the Gulf of Darien, which they generally accomplished in about 10 days.

San Lorenzo Point lies 2 miles 104° from Brava Point, the shore between them receding in a shoal-water bight. A reef projects about 2 miles southeastward from the point, and on the reef at 1½ miles from the point are the Paul Rocks, above water.

From San Lorenzo Point the shore line turns sharply northward and sweeps around in a semicircular curve to Pierce Point, a rocky projection 7 miles to the northeastward, forming within these points North Bay, in which the depths are quite regular from 2\frac{3}{4} to 2 fathoms. A mud flat borders most of the shore, and several streams enter the bay, among them being the Rivers Congo and Cupunadi. In the western part of the bay is a shoal bank of triangular shape, about 3 miles on a side, with depths of \frac{1}{2} fathom, and on this bank are the Islands Iguana and Iguanita and the Amelia Islets and Rocks. Lost Rock lies 2 miles north of San Lorenzo Point and \frac{1}{4} mile from shore.

From Pierce Point a reef projects about \(\frac{3}{4} \) mile to the southward, with a rock above water near its outer end. McKinnon Bay, a

small bight with shoal water at the head, lies eastward of the point and reef. Peris Point, 4 miles northeastward of Pierce Point, marks a sharp turn of the shore line to the northward at the beginning of the Boca Grande.

Garachine Point, the southern entrance point of San Miguel Bay (reported to be 3 miles westward of charted position), is at the extremity of a peninsula projecting 5½ miles northward from the mainland, with an average breadth of 2 miles. The land to the southward and eastward of the peninsula is lofty, Mount Zapo, noticeable as a sharp conical peak about 5 miles from the coast, rising to an elevation of 3,000 feet above the sea. A high, bold, and wooded coast, apparently free from dangers and with deep water close-to, extends southward about 30 miles to Pinas Bay. Cape Escarpado, with a small bight just above it, open to the northwestward, lies about 3 miles southward of the point.

Garachine Point is clean, and on its northern side may be closely skirted; but on the eastern side the line of 3 fathoms runs eastward from the extremity of the point. There is an islet 3 feet above water, 3 miles 229° from Garachine Point.

Garachine or South Bay, lying within Garachine Point and Patena Point, 11½ miles to the northeastward, is shoal, with a low mangrove shore from which mud banks extend to a distance of 3 miles; these flats are fronted by a shoal bank with 2 to 3 fathoms, occupying much of the remaining area of the bay. Several small streams enter the bay, and a channel with ½ fathom of water leads across the mud flat to the mouth of the River Sambu. Along the eastern side of the Garachine Peninsula extends a tongue of water with a depth of 2¼ fathoms, forming a small harbor with anchorage for small vessels near Garachine village, a small collection of huts at the head, where enters the River Alquitran.

Vessels may anchor close-off either Garachine or Patena Points, the depth of water being convenient.

Patena Point is low, sharp, and projecting, with Patenito Islet close outside and deep water near islet and point. Colorada Point, about 2\frac{3}{4} miles northeastward of Patena, is bold and rocky, with a conspicuous patch of reddish clay on its face; within the points the shore recedes about 1\frac{1}{2} miles, forming Charles Bay. From Colorada to Corales Point, 1\frac{3}{4} miles to the northeastward, the shore gradually gets lower, and from the latter point sweeps around to Virgin Point, forming a bay with low mangrove shores, nearly 5 miles wide between the points; at the head is Corales village, about a mile southeast of the point, with anchorage off it at \frac{1}{2} mile; the shore of the bay is bordered by shoal water to the distance of \frac{3}{8} to \frac{3}{4} mile, outside of which are apparently no dangers.

Reef.—A reef which dries 4 feet at low water is about 1,500 yards 74° from Corales Point. The reef is about 400 yards long, with depths of 4 fathoms surrounding.

From Virgin Point the shore line in its general trend turns gradually northward for nearly 5 miles to Virago Point, at the entrance of the Boca Chica; in this space are several little bays lined with mangrove, the points generally being of small elevation, rocky, and covered with bush. Bains Bluff, 1 mile southward of Virago Point, should be avoided on account of a ledge of rocks off it at 600 yards; the shore between the bluff and the point is also bordered by shoal water.

Cedar or Washington Island, 3½ miles northeastward of Corales Point and 1½ miles westward of Virgin Point, is about 600 yards long and wide, and densely covered with wood; several islets and rocks extend southward from it, and these, with the shoal extending from the opposite shore, take up much of the width of the channel on this side of the island. The best and most direct channel up the bay is northward of the island, and between it and Jones Islet, a conspicuous little rock about 20 feet high and covered with grass, lying 1½ miles to the northwestward of Cedar, both being clean and safe of approach, with 10 fathoms in mid-channel.

Strain Island, 2½ miles northeastward of Cedar and 1½ miles from the eastern shore, is about 25 feet high and covered with trees and shrubs; it is surrounded by a ledge of rocks, extending a short distance off it toward the channel, and is connected by mud banks with two islands westward of it.

Between Strain Island and the western shore are Jorey Island, a chain of islets called Los Gombales, Edith Islet, and Mary Islet, all forming a group within the 5-fathom line, covering an area of 2 miles by 1½ miles; Strain is the southeasternmost of the group and nearest the channel.

Anchorage.—The space included between Cedar, Jones, and this group of islets appears to afford the most favorable anchorage for vessels not wishing to enter Darien Harbor, or obliged to wait for the tide in order to do so on account of the strong tidal currents and eddies in the entrances.

Barry Rock, $\frac{7}{8}$ mile southwest of Strain Island and $\frac{3}{8}$ mile north of Seaford Point, is 20 feet high, covered with cactuses, and surrounded by deep water; the channel is between the rock and the island and has a depth of 10 fathoms.

Stanley Island, low and wooded, 1½ miles long by 1 mile wide, divides the channel into two passages, both leading into Darien Harbor; the principal one, the Boca Grande, forms a continuation of San Miguel Bay to the northward along the western and northern

sides of the island, while the Boca Chica skirts its southern side, lying between the island and Virago Point.

The Boca Chica has on either side of its outer entrance a dangerous ledge of rocks, the passage between them being but about 200 yards wide; the southern ledge, called Columbia Rocks, projects about ½ mile westward from Virago Point and shows only at low-water spring tides; the Foley Rocks lie along the northern side of the channel, extending nearly ½ mile westward from the southern point of the island and uncovering at half tide; north of this ledge is Trevan Islet. At ¾ mile within the entrance the channel narrows to about 50 yards, the width between the shores being less than 200 yards. A small ledge makes out a short distance from Buena Vista, the southeastern point of Stanley Island, having passed which the vessel will be in Darien Harbor, and may anchor, as convenient, in 5 to 10 fathoms, sand and mud.

Although the Boca Chica carries a low-water depth of 5 fathoms its use is not recommended unless at slack water, for during the strength of the tide the velocity of the stream reaches 6 to 7 knots, and the eddies make steerage difficult.

Leading mark.—The northwestern extremity of Jorey Island and the middle of Mary Islet in line, 238°, clears the rocks in the entrance of the Boca Chica; when past these rocks a vessel should keep in midchannel, and when past the reef off Buena Vista Point haul a little to the northward to give Price Point a berth of 150 yards.

The Boca Grande is a little over a mile wide at the entrance, between the rocks outside the Boca Chica and Milne Island, on the western shore, and continues for 1½ miles at about the same width between Stanley Island and the shore. A dangerous rock, only showing at about three-quarters ebb and connected by a ledge with the island, lies off its northwestern point, and from the opposite shore a shoal extends § mile, leaving between rock and shoal a width of § mile for the navigable channel; this now bends to the eastward and continues of the same width between Ray and Jeannette Islands, on the north, and a large flat rock, nearly always uncovered, and a small wooded island, about 200 yards off Stanley Island, on the south; then bending southeastward it continues between Ellen and Paley Islands on the west and the main shore on the east into Darien Harbor, gradually broadening after passing the former island and attaining a width of nearly 2 miles abreast of the Boca Chica.

Savannah Point is the southern extremity of the long, low peninsula separating for a distance of 5 miles the Savannah River from the Boca Grande. Foul ground borders the point, extending off 4 mile, and at that distance south of the point is a small islet with deep water close along its southern edge. Graham Point, 4

mile beyond Savannah, marks the entrance of the river, and has close off it the tiny islet La Pantila.

Vaguila Rock, showing at about half tide, lies a little over ½ mile south of Savannah Point. There is a good channel, ¾ mile wide, between the rock and the islet off the point, with 9 to 11 fathoms of water.

Directions.—To pass through the Boca Grande: After passing Barry Rock a vessel may haul up for the southwest end of Stanley Island, keeping on the range of Barry Rock and Virgin Point until Jones Islet comes in range with Strain Island; then steer to pass about ½ mile from Milne Island, and as soon as Mary Island is shut in by Milne, steer for Ray Island, keeping the eastern end of Edith Island a little open of Milne; following the channel, pass Ray at ½ mile, and as soon as Ellen Island opens from Turk Island haul to the southward, giving these islands and then Paley Island a berth of ½ mile to starboard, and anchor, as convenient, in 5 to 10 fathoms; bottom, sand and mud.

Caution.—It is reported that the shoals and reefs extend further northwestward and westward from Stanley Island than charted. Vessels should use great caution until more definite information is obtained.

Darien Harbor, formed by the junction of the Tuyra and Savannah Rivers, extends in a southeasterly direction from the Boca Grande to the village of Chipigana on the southern bank of the Tuyra, a distance of 11 miles, with a width of 4 miles in the northern part and 2 miles at the village. The depth of water is from 7 to 10 fathoms from Paley Island to the mouth of the Savannah, beyond which it shoals rapidly, almost the entire harbor having a uniform depth of from 13 to 17 feet. Off Chipigana there is a depth of 3½ fathoms for an area of about 1 mile by 1½ miles, affording excellent anchorage for vessels not exceeding that draft, to which it is accessible by taking advantage of the tides. During spring tides, which here rise 22 feet, the currents both of ebb and flood run at this point with great velocity, and especially is this the case during freshets, when it is sometimes difficult for a vessel to remain at anchor.

The shores of the harbor are almost a continuous line of mangrove, intersected by numerous small streams, with densely wooded hills from 100 to 300 feet high a short distance inland. Cripigana is a town of about 600 inhabitants, mostly negroes, of which race almost the whole population of Darien is composed. The houses are built of bamboo, and everything is of the most primitive description, a compromise between barbarism and civilization.

La Palma village, on the western shore, just at the inner entrance to the Boca Grande and at the beginning of the shoal water of the harbor, appears to be situated at the best point, and has an abundance of fresh water.

Anchorage.—The best place for anchorage is in 7 to 10 fathoms off Palma village, about a mile southeastward of Price Point and 600 yards from the shore.

Tides.—High water, full and change, in Darien Harbor is at 4h. 15m.; the mean rise and fall of tide is 16 feet. The tidal streams in the narrows are very strong, especially at the time of springs, which are said to rise 24 feet. Great care is required in the navigation, and it would seem advisable, at least for a stranger, to wait for slack water before attempting the passages.

Productions.—All tropical productions of the Western Hemis sphere can be grown here; maize, rice, sugar, coffee, cocoa, yams, and plantains grow almost wild; mahogany can be had in abundance; also the palm and the india-rubber tree abound. This fine harbor, with its extensive rivers penetrating into the interior, in the hands of an energetic people that would cultivate the fertile soil of the region, would soon become a place of importance.

Climate.—There is a rainy and a dry season, the former beginning in May and lasting until November, accompanied by lightning and thunder, and winds peculiar to the Gulf of Panama; for the other six months of the year the weather is fine. With common care, the country is comparatively healthy.

Tuyra River, the Santa Maria of the Spaniards and buccaneers rises in latitude 7° 40′ N. and enters Darien Harbor near the village of Chipigana. About 26 miles above this village and a mile above the junction of the river Chucunaqua are the ruins of the old Spanish fort of Santa Maria, near which were the gold mines worked by the Spaniards in the seventeenth century. As far as Santa Maria, which is the head of navigation for all craft but canoes, the depths in the river are from 1 to 5 fathoms; above this point a steam launch drawing 3½ feet could go only during spring tides.

The spring tides extend during the dry season to some 3 miles above Pinogana, which is 48 miles by river above Chipigana, but at this point the flood does not run more than two hours, with an extreme rise of 4 feet. During the neap tides the rise barely reaches Pinogana, and during the rainy season the influence of the tide extends but half the distance, owing to the great amount of water to be backed up.

By following the bends a depth of 30 feet can be carried 20 miles above Chipigana, except at the crossings, where there is but 22 feet at ordinary high tide; above this point the channel of the Tuyra narrows considerably and the depth decreases. The country as far up as Pinogana is flat and marshy a long distance back from the river, and is overflowed during high water in the autumn.

Chucunaqua River, which joins the Tuyra from the north at a point 25 miles above Chipigana village, rises in latitude 8° 50′ N., westward of Caledonia Bay on the Atlantic; its course appears to have been the favorite track of the buccaneers from the Atlantic to the Pacific.

Savannah River rises in latitude 8° 44′ N. and a few miles from its source meets the River Loro, where the bottom is level with the half tide. Below this point for about 10 miles there is a general depth of 1½ fathoms, except in two places, where banks with only ½ fathom extend from shore to shore; thence to the mouth of the river, a distance of 12 miles, there is a good navigable channel with a least depth of 3½ fathoms, except for a stretch of 1½ miles with 2¼ fathoms, just above the junction of the Rio Ingles. The navigable entrance is about ¾ mile wide between Graham Point and Haydon Bank, the channel narrowing within to about ¾ mile. The shores of the river are low mangrove land, skirted with hills 200 to 300 feet high, within 2 miles of the banks.

San Jose Bank, a dangerous shoal in the center of which is the Trollope Rock with only 2 feet of water on it, lies in the fairway of vessels bound to Panama from the southward, the rock being 15 miles 272° from Garachine Point, and 10 miles 118° of Galera Island, the southeasternmost of the Perlas Islands. The bank is 1 mile in diameter within the 5-fathom line, and 2\frac{3}{4} miles long by 2 miles wide within the 10-fathom line, outside of which the water deepens in general quickly; close to the rock are 2\frac{3}{4}, 3\frac{1}{4}, and 4 fathoms. Vessels should not approach within the depth of 10 fathoms.

Marks.—The Trollope Rock may be easily avoided, either by keeping along the main shore until past Garachine Point or by passing about 2 miles from Galera Island, with care for the shoal patch and rocks off its southern side.

THE PERLAS ISLANDS.

The Perlas Islands, also known as Islas del Rey and Islas des Istmo, form an archipelago consisting of 16 islands and numerous rocks covering an area of 450 square miles on the eastern side of the Gulf of Panama. These islands constitute the largest group in Panama Bay, and lie in the central northern part. It is about 30 miles long from north to south and 20 miles broad in its widest part, toward the center of the group. Rey Island, at the southeast end of the group, 15 miles long and 8 miles wide, is the largest. It is about 600 feet high. The other principal islands are San Jose, at the southwest end, 7 miles long, and averaging about 3 miles wide; Pedro Gonzales and Bayoneta Islands, in the central western part; and Saboga Island, at the northern end. In general the group is high

and wooded, with a steep shore line and low cliffs near the beach, and cultivated patches here and there. Around the shores and between the larger islands there are numerous smaller ones, amongst which are many reefs and sunken rocks.

There is no occasion for any other than small coastwise steamers to go close to the islands, but, should a vessel be out of her reckoning and sight them when bound to Balboa or Panama, she should leave the group to the eastward and give San Jose a berth of about 2 miles, and then lay a course for Taboguilla Island. Fortunately the southwest shores of San Jose are free from offshore dangers, and there is deep water close up to the shore line.

The channel to the eastward between Perlas Islands and the mainland is not used by steamers, except in rare instances, or by other than small coastwise vessels with local knowledge. San Jose Bank and Trollope Rock obstruct the middle of its southern entrance, and, should a vessel get too close inshore on either side, there are hidden dangers.

Scattered among these islands are numerous fishing villages. The inhabitants are chiefly engaged in the pearl fishery. The pearl shells gathered here, also an article of commerce, are known as Panama or Bullock shells, and are shipped to San Francisco or Panama.

Saboga anchorage.—This good and spacious harbor, about 2 miles long, north and south, and nearly 1 mile wide, with an average depth of 9 fathoms, lying at the extreme northern end of the archipelago, is formed by three islands and numerous islets and shoals. Saboga, the largest island, 1\frac{3}{4} miles long by an average width of \frac{1}{2} mile, is on the southwestern side; from its northern end a reef and shoal extend 1\frac{1}{4} miles to the northward, protecting the harbor on the west; Contadora Island, 1\frac{1}{2} miles long and \frac{1}{2} mile wide, forms the southeastern side; and Pacheca Island, \frac{3}{4} mile long and \frac{1}{2} mile wide, the northern side; about midway between these two islands is Bartholomew Islet, north and south from which extend shoals, protecting the harbor on the eastern side.

Channels.—Three channels lead into the harbor, respectively from the northwest, the east, and the south. The Pacheca Channel, southward of this island, is nearly ½ mile wide and appears to carry a depth of not less than 5½ fathoms in a straight course, but should be more closely examined, as there is a deficiency of soundings. Bartholomew Islet on a bearing 114° leads through in about mid-channel. Contadora, northward of the island, is at present the deepest and safest channel, carrying a least depth of 9 fathoms by keeping the northern end of Saboga just open of the southern end of Near Islet, 265°, Saboga Channel, between this and Contadora, appears to have a 5-fathom channel, but must be navigated with caution, and is not recommended before further examination on account of the shoals

obstructing the entrance and reported shoal patches outside. If this harbor were to be much used a few buoys would greatly assist the navigation.

A considerable village, with a church, lies on the northeastern shore of Saboga Island, at the head of a bay filled with a shoal and a reef; the usual anchorage is in 7 or 8 fathoms at ½ mile off this village. Contadora has 5 fathoms close along its northwestern shore, which is low and well adapted for wharves.

Tides.—High water, full and change, at Saboga anchorage is at 4h. 0 m.; springs rise about 14 feet.

Chapera and Pajaros, the next islands to the southward of Contadora, have a 4-fathom channel between them, but it should not be used, as the ground is foul; a 2½-fathom shoal lies ¾ mile eastward of Pajaros, and southward of this island the soundings are very irregular, with rock bottom. No vessel should attempt the passages between Pajaros and Rey Islands without previous examination and marking the points of the shoals.

Casaya, Bayoneta, and Viveros are the largest of a cluster of islands on what may be termed an extensive reef, about 8 miles long by 5 miles broad, stretching off the northwestern point of Rey Island; there are also numerous islets and rocks rising from the reef, and the passages between them all are foul, with occasional strong tides. A bank 1½ miles long by ¾ mile wide, with only 9 feet of water on its shoalest part, lies nearly 4 miles eastward of the northern point of Casaya; and the Caracoles and Cangrejo Islets, with foul ground around them, lie about 2 miles off the northeastern point of Viveros.

Clearing marks.—The entire group of islands stretching north-westward from the northwestern point of Rey Island should be avoided by Panama-bound vessels, which should not approach the islands on their western side nearer than just to open the eastern point of San Jose eastward of Pedro Gonzales Island, bearing 174°; and on their eastern side should not open San Pablo, an islet off the northeastern side of Rey Island, or bring it to bear eastward of 149°.

Rey Island, the largest of the Perlas Group, is about 15 miles long, north and south, by 7 miles wide, with several peaks, the highest being 600 feet high. Numerous islets and shoal patches, with deep water between them, lie 3 miles off the western shore, but should not be approached by strangers within the depth of 10 fathoms. Cocos Point, the southern extremity, is the end of a remarkable promontory, 4 miles long by about 1 mile wide, jutting southward into the sea. Its extreme cliff was formerly crowned by an umbrella-like tree, making it conspicuous, but no recent information concerning it is available.

Off the eastern shore of Rey are also islands, but they are steep-to and may be approached within $\frac{1}{2}$ miles, with the exception of Canas

Island, off which is a 3-fathom patch lying outside of a sunken rock, nearly 1½ miles from the shore. This may be easily avoided by not opening Monge Islet eastward of St. Elmo Island until Pablo Islet opens eastward of Muerta, a small barren islet lying about 1 mile northward of this patch.

St. Elmo Bay, on the eastern side of Cocos Point, is open to the southeastward, but has convenient anchorage in all parts in 6 to 9 fathoms, and a good stream of water near Lemon Point at its head.

San Miguel, the principal town of these islands, is on the north side of Rey; it is of considerable size, with conspicuous church, but is badly situated, landing at low water being difficult. Cerro Congo and Cerro Vali rise southward of the town, the former being 481 feet high. Supplies are uncertain and dear, all productions of the island being generally sent to Panama.

Anchorage.—Vessels having to lie off the town should run in between Caracoles and Cangrejo Islets, taking care not to shoal the water under 7 fathoms at low water and using caution in the approach, as the bottom is irregular and rocks abound; anchor in about 6 to 7 fathoms when the church is shut in, or behind Afuera, an islet lying off the town, bearing 151°.

Galera Island, lying 8 miles 199° from Cocos Point, is small, and, like the point, remarkable for its umbrella tree. A cliff forms its southern side, sloping down to a beach on the north, and to the southward a reef runs off for nearly 1 mile. This island is generally the first land made by vessels bound to Panama; it should not be approached within the depth of 10 fathoms, but between it and Cocos Point there is a good passage by using which the vessel will be clear of the San José Bank, 10 miles to the southeastward.

Pedro Gonzales Island, separated from the islets off the western side of Rey Island by a broad, deep channel, is of irregular shape, with an extreme length, northwest and southeast, of 3\frac{5}{8} miles by an average width of \frac{1}{2} mile, and has on its northern side a wide and deep indentation forming two bays, Perry and Magicienne, partially protected on the north by the small islands Señora and Señorita. Trapiche Island, 100 feet high, which is connected by a sandy neck with Gonzales at low-water springs, forms the division between the two bays; off the eastern point of Trapiche extends a rocky ledge, and from this extends a shoal with 14 feet of water at the end, nearly 600 yards from the point. Perry Bay, which lies within this shoal and Swift Point on the opposite side, is a mile wide and penetrates nearly a mile, affording anchorage in 5 to 7 fathoms, with good protection from wind and sea.

A large stream of water, found in full force in the month of April at the end of what had been considered a remarkably dry season, runs into the sea on the western side of Magicienne Bay;

this bay, however, is small and shoal, having only a tongue of deep water, $3\frac{1}{4}$ fathoms, projecting $\frac{3}{8}$ mile within the entrance, with a width of $\frac{1}{8}$ mile. Señora, wooded and 70 feet high, and Señorita, small and 40 feet high, with the shoals off their eastern sides, have an extent of about 1 mile, and are separated from Trapiche by a 7-fathom channel, steep-to on both sides.

Tides.—High water, full and change, in Perry Bay is at 3h. 50m.; rise 16 feet. The tidal streams are not felt at the anchorage, but off the island there is considerable set, the flood running northward and the ebb southward, the latter being generally the stronger.

Directions.—Vessels may pass on either side of Señora and Señorita Islands, taking care to avoid the shoal eastward of them; if entering Perry Bay, the shoal off Trapiche may be avoided by not passing westward of midway between this island and Swift Point.

San José Island, lying 4 miles southward of Gonzales, is about 6½ miles long by 3 miles wide, and its summit forms a table-land said to be a considerable grazing ground. Nearly 2 miles southeastward from Iguana Point, the northern extremity of the island, a large waterfall, running into the sea, affords an excellent watering place. A deep bay indents the southeastern side of the island, but the swell sets in there with great violence. Off the southern end are a number of high rocks of singular and fantastic shapes, also lashed by a heavy surf; this part of the island should be avoided. The western shore is bold and cliffy, with a small bay near the middle, opening to the northwestward.

The channel, $6\frac{1}{2}$ miles wide, between Rey and San José Islands, is found on the Rey side, but deep and clear on the San José side, the depths exceeding 20 fathoms for two-thirds the length of the island.

Passage Rock.—This dangerous sunken rock, with 12 and 9 fathoms close around it, lies near the middle of the channel, otherwise deep and clear, between San José and Gonzales Islands.

Clearing marks.—The peak next south of the highest on Rey Island, just open south of Coco Islet, one of the outlying islets off the west side of Rey, bearing 78°, leads more than ½ mile southward of Passage Rock; vessels should keep between this line and the San José shore.

Bound to Panama.—Vessels bound to Panama from the northward should make the island of Jicaron, which lies about 50 miles westward of Mariato Point, and from here endeavor to keep under the land as far as Cape Mala; or, if unable to do this, push across for the opposite coast, where the current will be in their favor. On getting to the eastward of Cape Mala the safest plan is to shape a

course for Galera Island and use the eastern passage, that between the Perlas Islands and the main. If, however, tempted up the gulf by a fair wind, vessels should endeavor to get on the western coast of the Perlas Islands, for the reasons noted below.

The passage from the southward into the Gulf of Panama is easily made during the greater part of the year by keeping about 60 miles from the coast northward of Guayaquil, and after crossing the line shaping a course for Galera Island, taking care, especially in the dry season, to stand inshore with the first northerly wind; by so doing, vessels will most probably have the current in their favor along the coast, whereas by keeping in the middle or on the western side of the gulf a strong southerly set will be experienced. After making Galera and clearing the San José Bank, the navigation between the Perlas Islands and the mainland is clear and easy, with the advantage of being able to anchor should the wind fail or the tide be unfavorable. As a rule, this passage should be taken, but with a strong southerly wind the navigator is tempted to run up the bay, in which case he should keep on the western shore of the Perlas Islands, where less current will be found, and anchorage should the wind fail, an event always to be expected in these regions. Between Chirambira Point and Cape Corrientes the land is low and faced with shoals, caused by the numerous rivers that have their outlets on this part of the coast; but after passing Cape Corrientes it may be approached fairly close except off Solano Point, where some rocky shoal patches extend seaward, as the coast is, in general, steep-to. Care, however, should be taken in a sailing vessel not to run into the calms caused by the high land, as it is difficult to get off into the breeze again, and the swell sets inshore, where there may be no anchorage until close to the rocks.

In beating up the Gulf of Panama in the fine season, the eastern passage is to be preferred, as, with one exception, it is free from dangers, the water is smooth, and a regular tide enables more northing to be made than would be possible in most cases against the strong current and short high sea which at this season prevail in the middle or on the western side of the gulf. During the rainy season a straight course up the bay is preferable to becoming entangled with the islands, the current generally following the direction of the wind.

Bound from Panama.—The great difficulty, however, is the passage out from Panama Bay. Pizarro, the first to attempt this, in November, 1525, after beating about for 70 days, was forced to return to the River Chiman.

The best plan for all sailing vessels, whether bound for ports north or south of Panama, is to push to the southward and gain the southeast trade; by so doing they will not only avoid the doldrums and vexatious winds, but will have the additional advantage of salu-

brious weather, with the sea at a temperature of 75° instead of 83° F. Between January and April it may be better for northbound vessels to cross the line between the Galapagos Islands and the coast before pushing westward, keeping south of the line until westward of 105° W., when a course may be shaped for 10° N. and 120° W., in which track they will probably find the northern trade. This will generally prove far preferable to encountering the vexatious weather met with at this season north of the Galapagos.

The passage to the northward has been made by keeping close inshore after passing Cape Mala, and navigating by the land and sea breezes; but this should be attempted only by vessels that are well found and manned, unless bound to the ports of Central America, when it is their only route.

The passage to the westward during the rainy season is a most tedious affair; calms, squalls, contrary winds and currents, a heavy swell, and extreme heat, as well as an atmosphere laden with moisture and rain, are the daily accompaniments. It often occurs that 20 miles of westing are not made in a week, and it is only by the industrious use of every squall and slant of wind that the passage can be made.

In the navigation of these regions and of the coasts of Central America and Mexico, even small auxiliary steam power proves most useful.



APPENDIX.

PANAMA CANAL ZONE.

Defensive sea areas.—The following general order issued by the commanding officer, Panama Canal and Canal Zone is in force:

I. Defensive sea areas are hereby established, to be maintained until further notice, at the places and within the limits prescribed below:

PACIFIC ENTRANCE.

Outer limit.—Three gas buoys have been established to mark the outer limits of the defensive sea area, Panama Bay. These buoys are cylindrical, with pyramidal superstructures, painted white, and each exhibits an occulting white light 12 feet above the water, visible 6 miles. The buoys are located as follows:

Outer Buoy, 5 miles from the northern extremity of Taboguilla Island, on the bearings:

Northern extremity Taboguilla Island	233°	
Tortola Island, right tangent	268°	45'
San Jose Rock, center	299°	

Taboguilla Buoy, 1,000 yards from the northern extremity of Taboguilla Island, on the bearings:

Taboguilla Island, left tangent	175°	30'
Taboga Island, right tangent	250°	
Tortola Island, right tangent	306°	

Inner Buoy, 2 miles from the center of San Jose Rock, on the bearings:

Taboguilla Island, left tangent	191°
San Jose Rock, center	233°
San Jose Rock, center	299°

Inner limit.—A line joining Guinea Point with the inner end of the causeway.

- II. The following orders and regulations are promulgated for the government of persons and vessels within the limits of the defensive sea areas:
- 1. In the neighborhood of each defensive sea area the following entrances are designated for incoming and outgoing vessels:

Designated entrance for incoming vessels.—A patrol boat stationed 1 mile 90° from the northern end of Taboguilla Island.

Designated entrance for outgoing vessels.—The canal prism.

2. A vessel desiring to cross a defensive sea area shall proceed to the vicinity of the entrance, flying her national colors, together with International Code number and pilot signal, and there await communication with the harborentrance patrol. It is expressly prohibited for any vessel to enter the limits of

a defensive sea area otherwise than at a designated entrance and after authorization by the harbor-entrance patrol.

- 3. Boats and other craft employed in the harbor-entrance patrol will be distinguished by the union jack, which will be shown from a position forward. At night they may show a vertical hoist of three lights—white, red, and white, in the order named.
- 4. On receiving permission from the harbor-entrance patrol to enter a defensive sea area, a vessel must comply with all instructions as to pilotage and other matters that she may receive from proper authority, either before or during her passage across the area; it is understood that only upon condition of such compliance is the said permission granted.
- 5. No permission will be granted to other than a public vessel of the United States or a canal craft to cross a defensive sea area between sunset and sunrise, nor during the prevalence of weather conditions that render navigation difficult or dangerous. A vessel arriving off a defensive sea area after sunset shall anchor or lie to at a distance of at least 1 mile outside its limits until the following sunrise; vessels discovered near the limits of the areas at night may be fired upon.
- 6. No vessel shall be permitted to proceed within the limits of a defensive sea area at a greater speed than 6 knots per hour.
- 7. All matters pertaining to fishery and the passage of small craft within a defensive sea area shall be regulated by the captain of the port concerned.
- 8. These regulations are subject to modification by the marine superintendent when the public interest may require, and such notification as circumstances may permit will be issued regarding modifications thus made.
- 9. Any master of a vessel or other person within the vicinity of a defensive sen area who shall violate these regulations, or shall fail to obey an order to stop and heave to, or shall perform any act threatening the efficiency of mine or other defenses or the safety of navigation, or shall take any action inimical to the interests of the United States in its prosecution of war, may be detained therein by force of arms and renders himself liable to prosecution.

Panama Canal—Necessity as to certain fittings for vessels.—The attention of all concerned is invited to the necessity for fitting closed chocks on vessels navigating the Panama Canal. In this connection the following extract from Sailing Directions and General Information regarding the Panama Canal is quoted:

"Towage through locks—Chocks, bitts, etc.—Ordinarily six locomotives will be used, two forward for towing and steadying the vessel in the lock chambers, two amidships for towing and afterwards for checking the vessel's headway, and two aft for steadying her and checking her headway.

"The average rise and fall in each lock chamber is about 30 feet; hence when a vessel is at the lowest level the lead through the ship's chocks to the locomotives on the lock walls is often very sharp, and unless the chocks be closed the line will have a tendency to slip out and damage the rail and other light-construction equipment in its vicinity. Experience has demonstrated the fact that most of the chocks and bitts are too light in construction, and that the chocks in particular should not only be made heavier and stronger, so that their jaws may stand a vertical strain, but that they should be of a permanently closed pattern and not be made with open jaws.

"Bitts should be sufficiently strong to withstand the strain of a $1\frac{1}{2}$ -inch (diameter) wire line with a pull of 50,000 pounds and be firmly riveted to the decks; and if necessary, where the deck is of wood or light plating, they should have an underdeck plate or be secured between two deck frames.

- "It has been noted that some vessels have light iron cleats riveted to the inside of the side plating or to the deck plates in lieu of bitts. This is very unsatisfactory, as almost invariably they will not stand the strain, owing to their light construction or insecure fastening. They should be replaced by bitts.
- "In the installation of chocks and bitts for Panama Canal towing attention should be given to placing the several sets in convenient and accessible places, and that in each set there should be but a short distance between the chock and its accompanying bitts.
- "On account of danger to the lock gates resulting therefrom the Panama Canal reserves the right to deny passage to ships having inadequate chocks and bitts as described herein until suitable equipment can be installed at the terminal ports.
- "Vessels carrying deck cargo must have it so arranged as to leave accessible all chocks, bitts, etc., for use of lines.
- "Protrusions beyond ship's sides.—Vessels should make ample provision for rigging in their accommodation ladders, boat davits, or any other part of their equipment which may protrude beyond their side; those fitted with cargo ports must keep them closed while passing through the locks, and in case they be hinged on the outside, should sling fenders in their wake to protect them from injury."

It is requested that shipping publications give publicity to the necessity for closed chocks on vessels navigating the canal, as it is desired to bring to the attention of shipbuilders, especially American shipbuilding plants now being organized and foreign shipowners and naval architects, the type of fittings required to insure vessels being safely towed through the locks.

Lights extinguished—Buoys removed—Ports closed at night.—The terminal ports of Cristobal and Balboa are now closed between the hours of sunset and sunrise.

All navigation lights will be extinguished and it will be necessary for vessels to arrive off these ports by daylight.

On account of the lights being extinguished and the buoys removed it will be unsafe for vessels to approach, either by day or night, nearer than 2 miles from the harbor entrances without canal pilots.

CANAL PUBLICATIONS.

The following have been published by the Panama Canal Zone authorities and are issued free of charge and should be in possession of all masters using the canal:

- 1. Sailing Directions and General Information. The Panama Canal, revised October, 1916.
- 2. The Panama Canal, Tariff No. 2. Schedule of Rates for Supplies and Services Furnished to Shipping and Allied Interests at the Panama Canal.
 - 3. Supplement No. 1 to Tariff No. 2, effective January 15, 1918.

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